American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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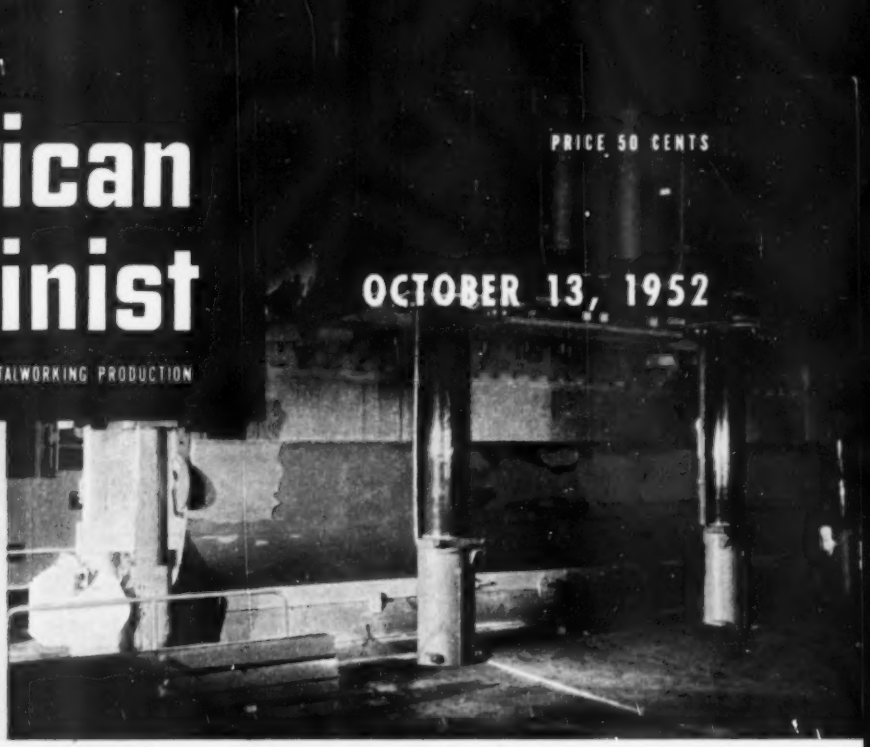
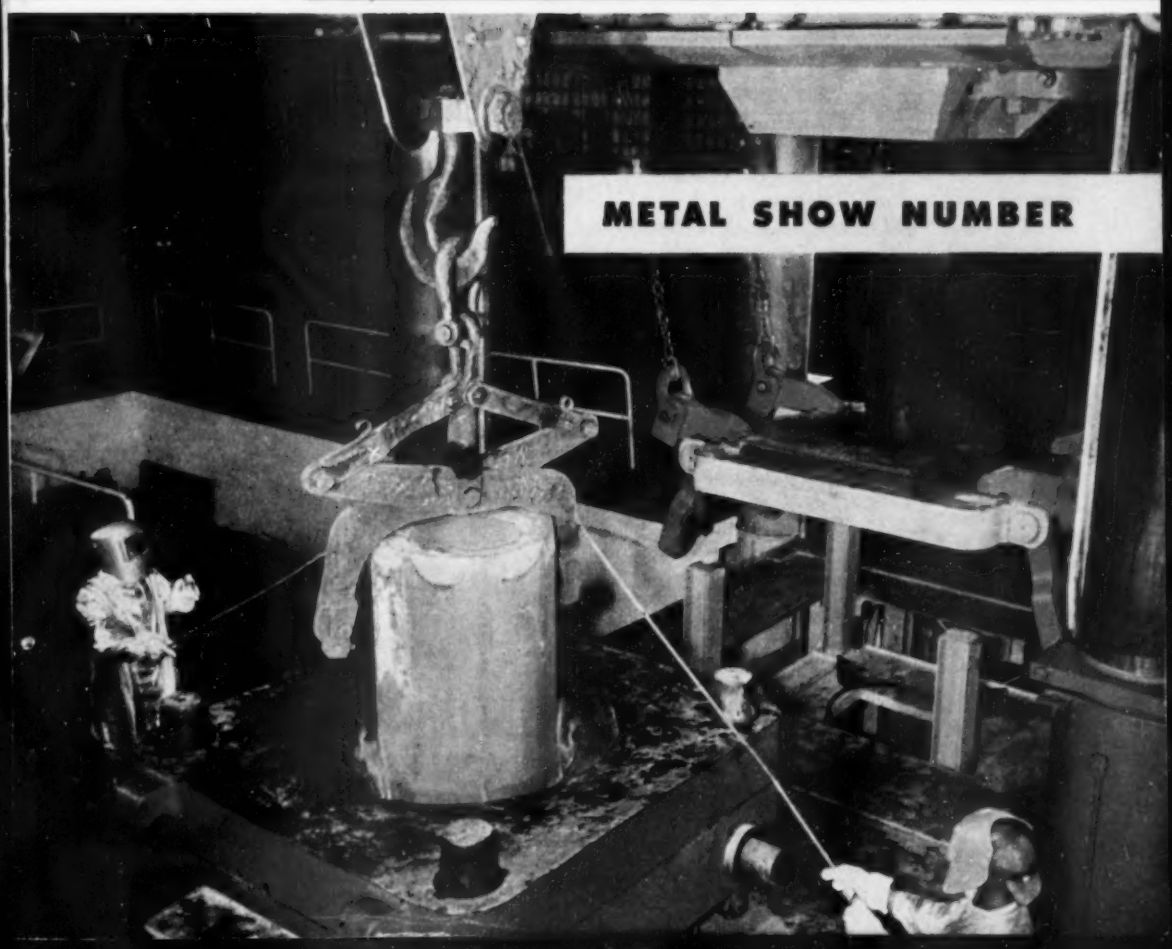
OCTOBER 13, 1952

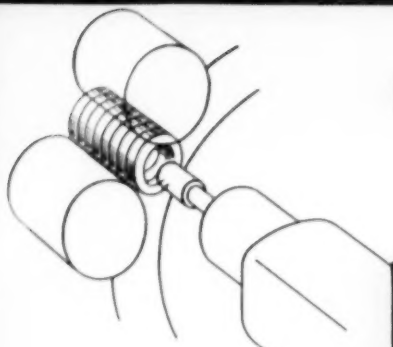


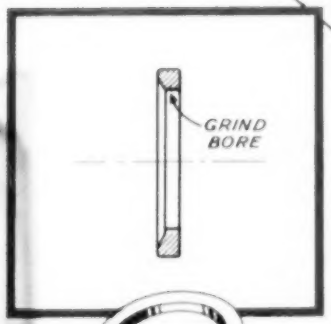
BIG, BUSY PRESS
Tables on rails assure flexibility for 6500-ton hydraulic press. When not bending 6-in. plate (right), it pierces 13-ton ingots (below) for hollow forgings (see page 2).

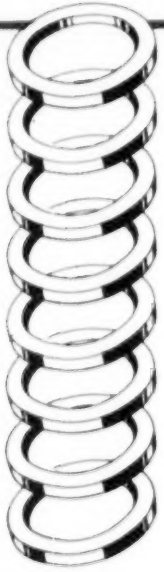


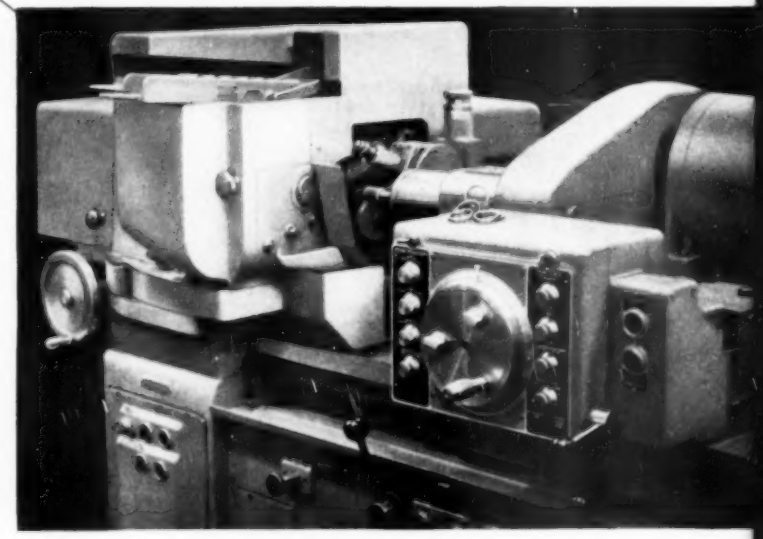
METAL SHOW NUMBER

Here's How the Heald handles a multiple grinding job









valve seat inserts ground 8 AT A TIME on a Heald Model 281 Centerless

With this fully automatic Heald Centerless Internal, valve seat inserts are ground eight at a time. The parts are stack loaded and drop into grinding position automatically, where they are located and rotated between the support, pressure and regulating rolls. Since they are rotated on their own outside diameter, concentricity between ground bore and O.D. is easily maintained. Size-Matic sizing is also fully automatic. Once the machine is started, all the operator has to do is keep the loading chute filled and remove the finished parts from the unloading chute.

This is typical of the high production efficiency that you can get with a Heald Centerless Internal. Remember — when it comes to precision finishing, it pays to come to Heald.

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Chips and Quips

Dual Purpose . . . Our cover is unusual this time in that it combines two pictures of the same machine—in this case a 6500-ton hydraulic press that Babcock & Wilcox built for its own use at Barberton, O. It bends heavy plate for boiler shells, also pierces big ingots for hollow forgings, the two jobs keeping it busy and justifying cost.

Metal Show . . . As usual, we observe the forthcoming Metal Show in Philadelphia by selecting editorial content for this issue to stress Show subjects—materials, welding, heat-treating, presswork. We also include a list of exhibitors and 8 pages of new products to be shown there that we haven't previously described.

Dies & Molds . . . Edwin DeVoss, tooling engineer at Northrop, describes a cam-action die that cut time for producing a seal for hot-air ducts on the *Scorpion* F-89 from 3 hr to 5 min. Dies do flanging and upset-beading in one stroke, controlling all dimensions closely . . . Federico Strasser adds a step-by-step procedure for die setup, including sketches, covering 22 major points . . . And we have a report on a powder-metal part, comparing tolerances with those on the earlier stamped one.

Conveyed Chips . . . David Peterson of Stewart-Warner tells how chips move from machines to crushers and on to railroad cars, untouched by hands in most cases. The system includes a new type of drag chain, as well as pneumatic elements on surface broaches.

Welding . . . Two articles on welding are included herewith, one on welding titanium, amplifying our earlier reports, and the other on a specific job—welding a spinner—on which tremendous savings were made by changing method. . . . A third article includes some material on welding, some on heat-treating, of stainless, as well as selection of proper grades for elevated temperature. Emphasis is on the low-carbon grades, developed to avoid intergranular corrosion when welded. J J Heger of US Steel wrote the story.

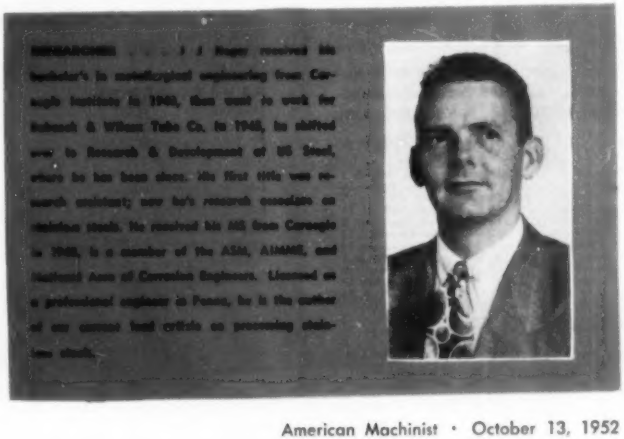
Hurt at Home? . . Many accidents happen in shops because of something that happens earlier at home. So some companies are now instituting safety programs to avoid "off-the-job" accidents. We provide details herewith . . . There is also another unusual article, dealing with tolerances for coordinate dimensions, a very practical approach to locating points on circles or radially.

Dynamometer . . . Study of machinability is bringing the metal-cutting dynamometer to the fore. Latest types are more compact and inexpensive because they are designed around strain gages. In this issue, we offer a description of the latest unit, for turning, and some description of recent ones in other areas of metal cutting . . . Operation is illustrated by new tests on titanium.

Keeping Heat Up . . . Never have we seen a thoroughgoing article on furnace maintenance—particularly on heat-treating furnaces. T A Frischman, chief metallurgist at Eaton Axle and a familiar contributor, has compressed his experience on the subject into a compact 12-page Special Report.

Brass . . . As a dividend, we're throwing in a fold-out insert on "How to Understand Brass." It's simplified metallurgy, written so anyone can follow it, by Sam Storchheim, senior metallurgist for Sylvania at Bayside, NY. It explains why brass compositions have varying characteristics, how to pick to avoid trouble and heat-treatment.

Coming . . . *AM* for Oct 27 has another in our series of "Tools of Our Trade," this one 16 pages on grinding. There are also articles on contour milling, on machining stainless with carbides, and on machinability of gray iron, plus several other articles of note.



THE ANSWER

FOR BETTER LARGE STRAIGHT BEVEL GEARS

This close-up of the sturdy tool slides on a Gleason No. 24A Straight Bevel Generator shows the answer for improved production of large straight bevel gears. By setting the Coniflex® adjusting dials pictured, any desired length of tooth contact can be obtained. Manufacturers of steel mill and mining machinery, power shovels, and similar heavy-duty equipment are using Coniflex gears, with tooth contact suited for the application, for easier assembly, smoother operation, and longer life.

Send us details of your large straight bevel gear applications. We will gladly show you how Coniflex gears, cut on the No. 24A, will improve your results.

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Defense Applications

for Cincinnati Vertical

Broaching gives you quick action in boosting production and lowering costs. This efficient method of machining should be employed wherever possible in the production of defense equipment items. Of course, a lot depends upon tooling, so if you need ideas write for our folder "How to Step Up Production with Cincinnati Hydro-Broach Machines," No. M-1599-1. And when you decide upon broaching, Cincinnati is your best choice. Our broaching specialists will be glad to help you with the application.

THE CINCINNATI MILLING MACHINE CO.
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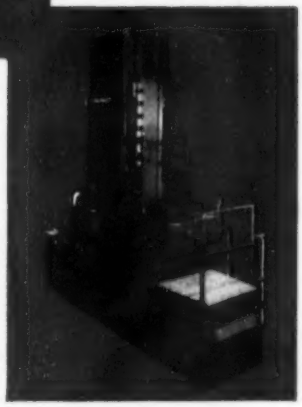
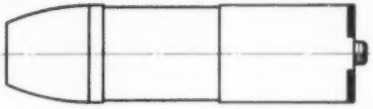
CINCINNATI Duplex Vertical Hydro-Broach Machines are built in four sizes, from No. 5-42 to 10-66. No. 10-66 is illustrated. Catalog No. 1709-1.



CINCINNATI Single Ram Vertical Hydro-Broach Machines are built in four sizes, from No. 5-42 to 10-66. No. 10-66 is illustrated. Catalog No. M-1745.

AUTOMATIC FIXTURES REDUCE EFFORT IN BROACHING KEY ON MORTAR SHELLS



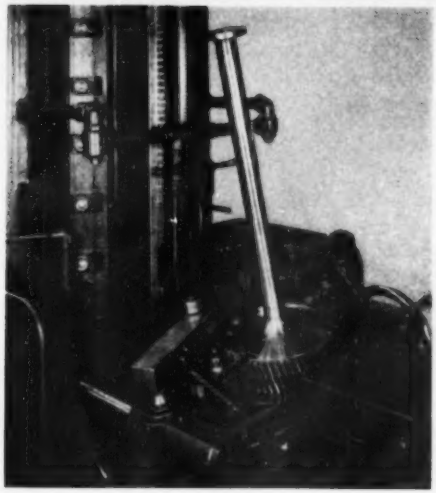
Part name	Chemical mortar shell
Material	Steel
Operation	Broach key on base
Stock removal	1/16"
Production	345 per hour
Machine	CINCINNATI No. 5-42 Duplex Vertical Hydro-Broach

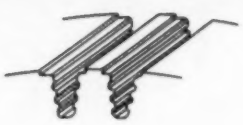
CINCIN

CINCINNATI

Hydro-Broach Machines

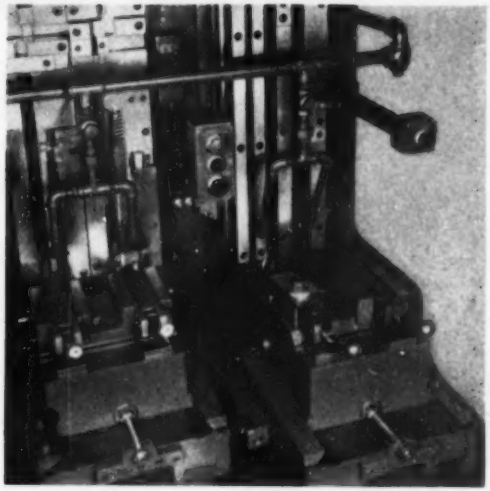
BROACHING TURBINE BLADE SLOTS IN ROTORS





Part name ..... Rotor
Material ..... Heat-resistant alloy steel
Operation ..... Broach turbine blade slots
Stock removal ..... From solid
Production ..... Depends upon several variables. For the above material ... on 66" stroke machine, 2 cuts, 1.38 minutes per slot; on 90" stroke machine, 1 cut, .9 minutes per slot
Machine ..... CINCINNATI Single Ram Vertical Hydro-Broach

ENTIRE PROFILE OF DETENT BROACHED IN FOUR PROGRESSIVE OPERATIONS

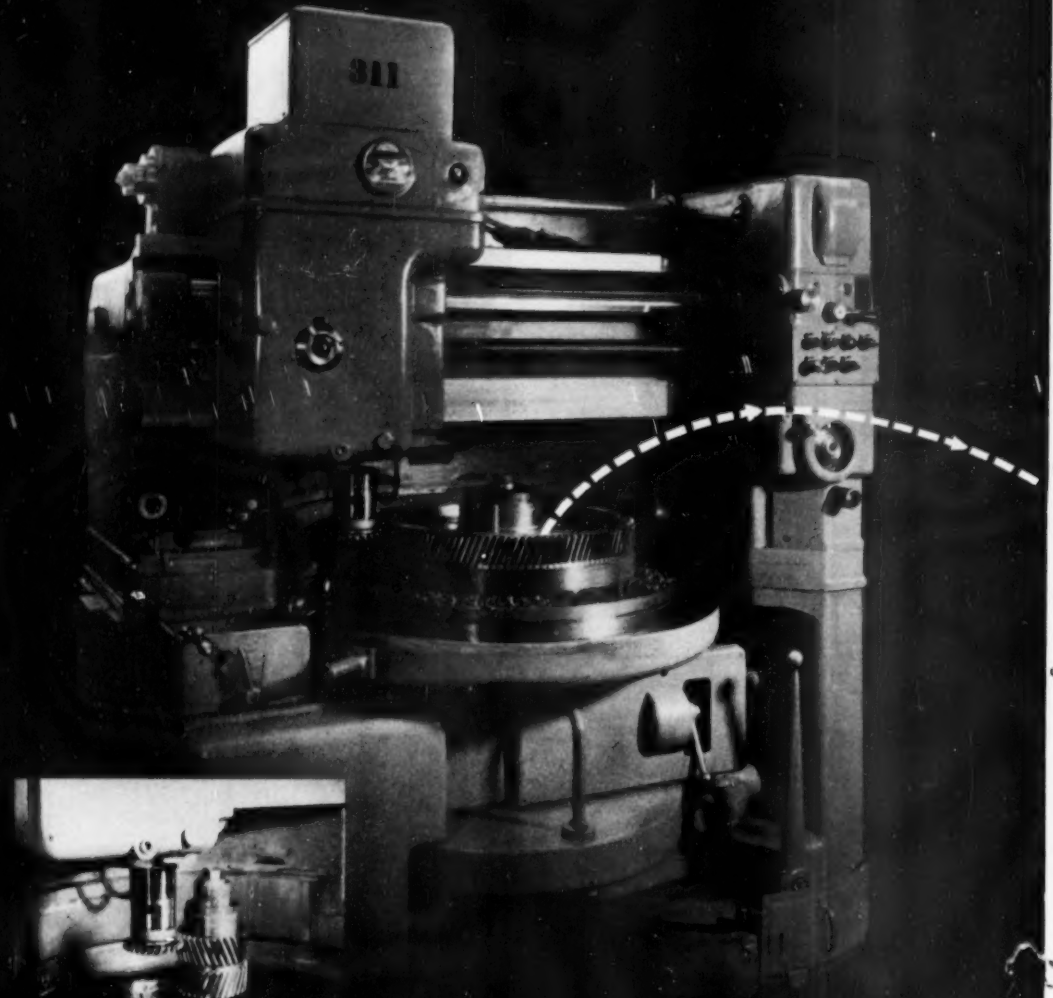


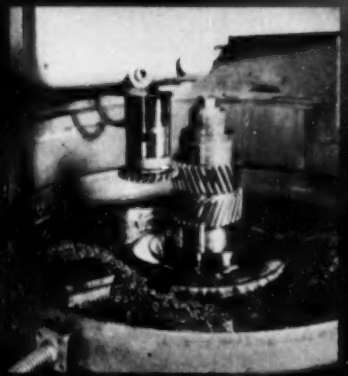
Part name ..... Detent
Material ..... Steel forging
Operation ..... Broach profile complete
Stock removal ..... 9/32" average
Production ..... 98 per hour, completely broached
Machine ..... CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach

NATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

How SNOW-NABSTEDT





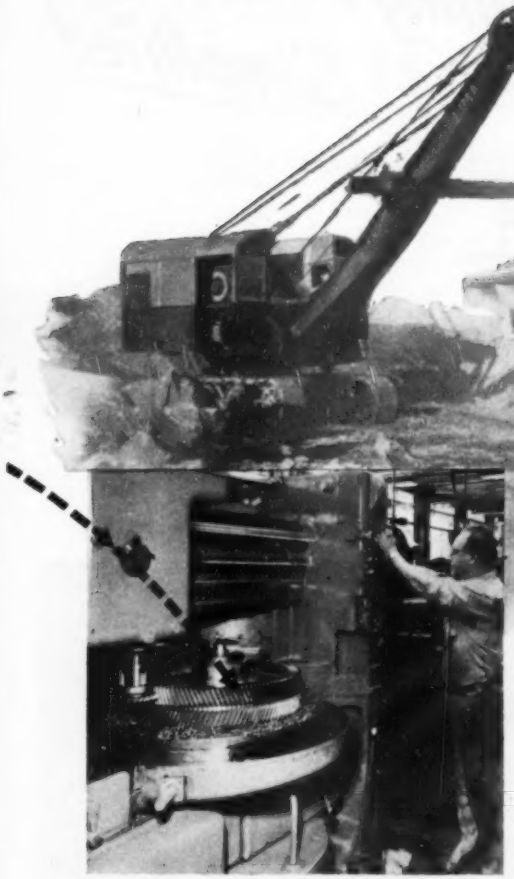
The 6.48" pinion being cut on Fellows "36" at Snow-Nabstedt Corporation.

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

uses 2 Fellows "36's"

to cut herringbone reduction gears



The left hand helix of 24.48" mate to pinion being rough- and finish-cut on second Fellows "36."

The Snow-Nabstedt Gear Corporation of Hamden, Conn., for years a leader in the manufacture of marine reverse and reduction gears, is now applying its know-how to the manufacture of standardized Reduction Gears for use in industrial, construction, and agricultural equipment.

To achieve top production, Snow-Nabstedt uses two Fellows 36-Type Gear Shapers simultaneously for cutting the 24.48" bull gear of the 3.9 to 1 reduction unit. The right hand helix of the herringbone is cut on the first machine. Then the gear blank is transferred to the second "36", 'flopped over', and the left hand helix cut. When a production run of mating pinions is put through, the same procedure and the same cutters are used. Production times are tabulated below.

For precision cutting of coarse pitch, broad face gears, the 36-Type Gear Shaper is in a class by itself. 'Beefed-Up' to take heavy cuts, it has the rigidity to hold fine finish as well. For good gears at low cost, investigate the Fellows 36-Type!

PRODUCTION DATA

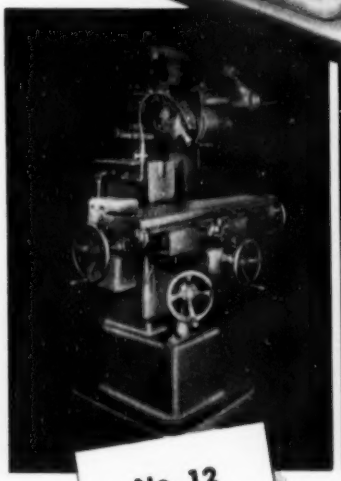
	Gear	Pinion
Outside Diam.	24.486 in.	6.486 in.
Pitch	5/7	5/7
No. of Teeth	121	31
Pressure Angle	20°	20°
Helix Angle	23°	23°
No. of Cuts	2	2
Limits (Mic. over balls)	±.002	±.002
Time—Roughing*	118 min.	23 min.
—Finish Cuts*	109 min.	34 min.

**For each hand of helix*

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1

Milling Production Simplified



No. 12
Table: 37½" x 9¼"
Cutterhead in
Angular Position

No. 16
Table: 37" x 9½"
Cutterhead in
Horizontal Position

No. 22L
Table: 45" x 10"
Cutterhead in
Vertical Position

VAN NORMAN

is Speeded, and More Accurate with

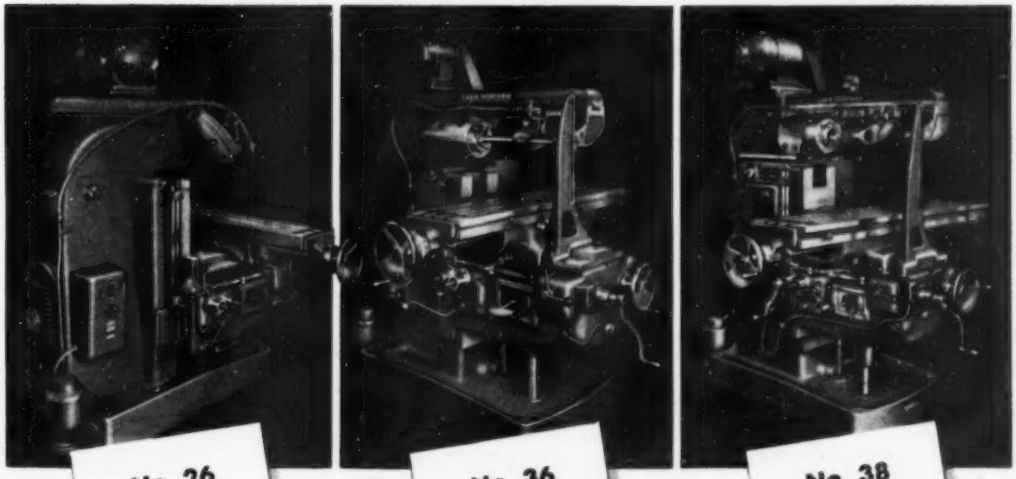
VAN NORMAN

Ram-Type Millers

Equip your toolroom and production lines with modern Van Norman Ram-Type Millers that provide new ease of set-up and control . . . smoothness in operation on the heaviest of cuts . . . and plenty of weight and power to keep on turning out work of highest accuracy under the strenuous schedules that today's conditions impose.

Featuring the adjustable cutterhead and movable ram, these Millers enable the operator to go from vertical to angular to horizontal milling with a minimum of resetting of work and with standard arbors and cutters. Operation is simplified because the controls are placed right at the operator's fingertips. Rigidity to maintain accuracy on the heaviest cut is assured by the balanced design of each machine.

All these features sum up to the highest output, fewest errors, lowest milling cost and machine maintenance. Find out how Van Norman Ram-Type Millers can save on your work. Write for catalogue.



No. 26
Table: 58" x 13"
Cutterhead in
Angular Position

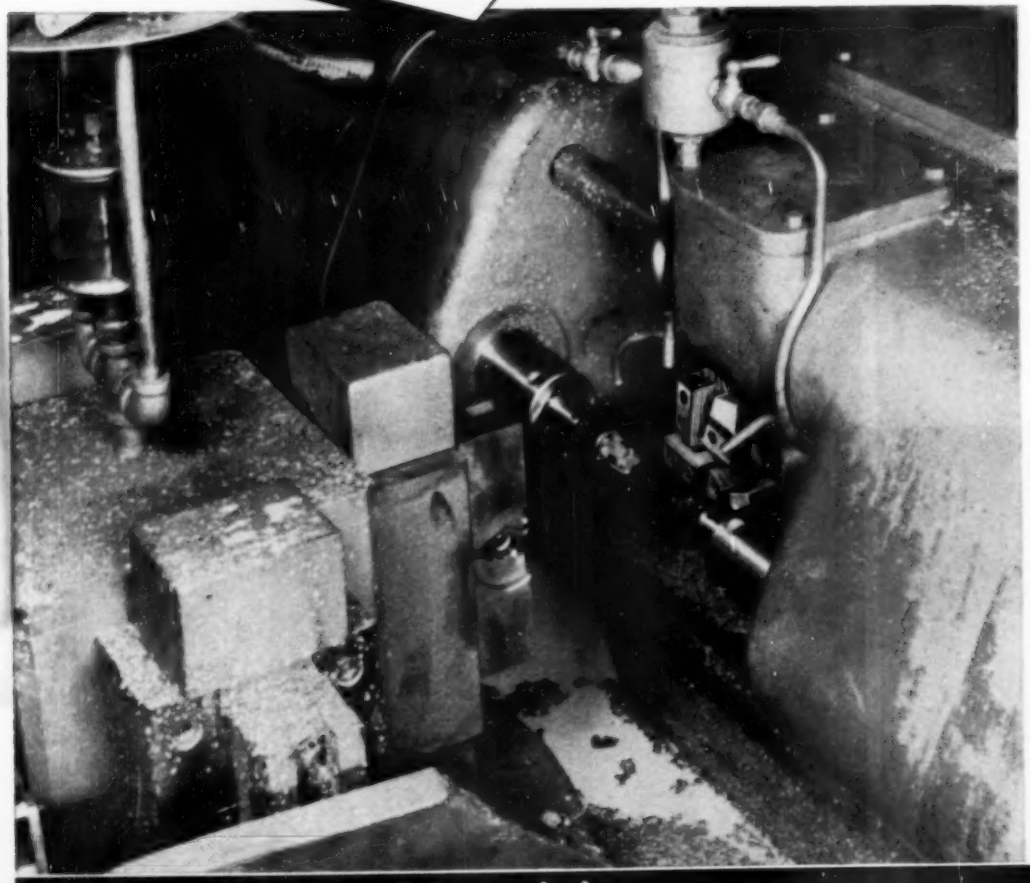
No. 36
Table: 64" x 14"
Cutterhead in
Horizontal Position

No. 38
Table: 64" x 14"
Cutterhead in
Horizontal Position

COMPANY, SPRINGFIELD, MASSACHUSETTS, U. S. A.

57% LESS

...ON



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THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD

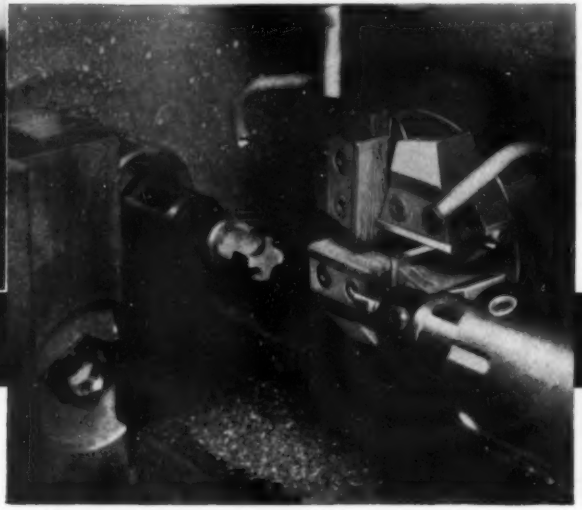
THREADING COST

AUTOMATIC CHUCKING MACHINE

A LANDIS Solid Adjustable Die Head cut the cost of one threading operation in the plant of a large Middle Western manufacturer by 57%.

The operation, performed on a Goss and DeLeeuw Automatic Chucking Machine, required the cutting of a 1-11/16" diameter 14 pitch thread ½" long on cast brass valve bodies. Prescribed tolerances were easily maintained.

The LANDIS Head fit perfectly into the highspeed cycle of the chucking machine, and produced an average of 210 finished pieces per hour, revolving at 385 RPM. Major factors in the efficiency of this LANDIS Head were low down-time and low tool cost, occasioned by long tool life. Output of finished pieces averaged from 4,000 to 5,000 between chaser grindings.



Please send job and machine specifications with your request for additional information.

LANDIS TRADE-MARK

WAYNESBORO PENNSYLVANIA

GENERATING EQUIPMENT

Electrolux Increases Armature

Landis 4" Plain Grinders replace equal number of older machines

Here is another example showing how Landis grinders have improved production and lowered costs.

Armature shafts at Electrolux were formerly ground on older machines which required time-consuming hand operations. The new Landis 4" type H plain

Landis 4" Type H Plain Grinder

Ask for Catalog A-49

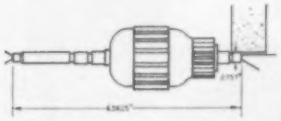
LANDIS

precision grinders

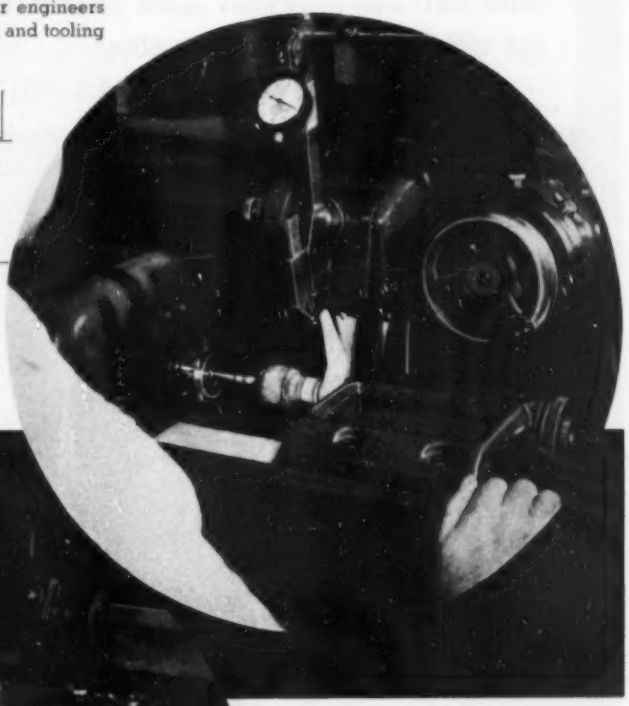
Grinding Output 40%

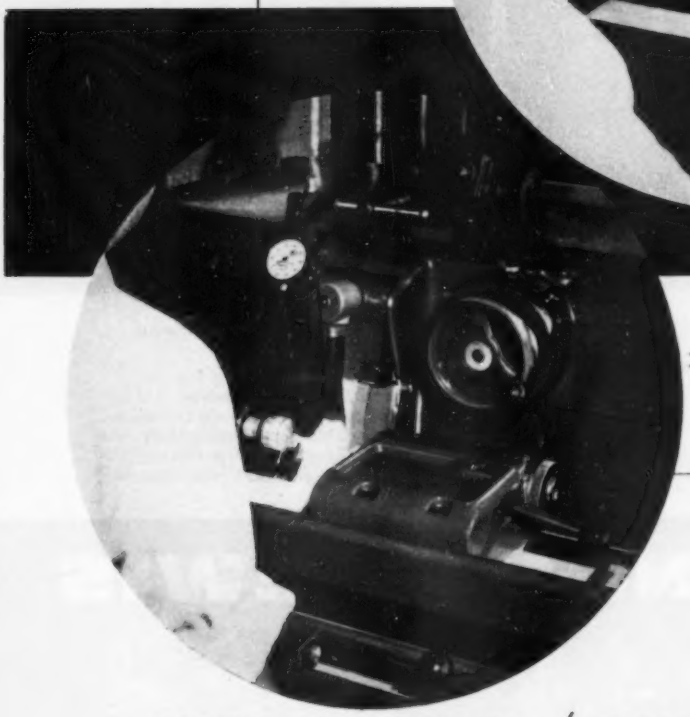
grinders with hydraulically operated rapid wheelbase movement, slow grinding feed, timed cycle and visual sizing gauges have made these gains possible.

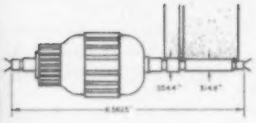
Whatever your grinding problem—our engineers will be glad to make production estimates and tooling suggestions from your work prints.



work data	
PRODUCTION	350 pieces per hour
OPERATION	grind small bearing
STOCK REMOVAL	.012" to .015"
TOLERANCE	.0002" on diameter







work data	
PRODUCTION	210 pieces per hour
OPERATION	grind large bearing and fan diameter
STOCK REMOVAL	.012" to .015"
TOLERANCE	.0002" on diameter

151

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

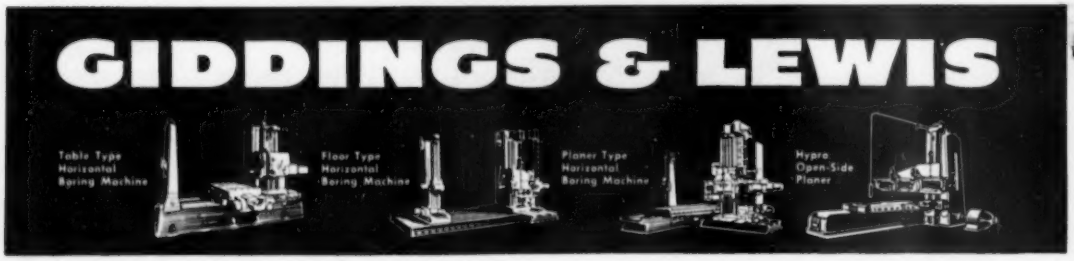
This high-priority job demands

Three G&L 340-T machines speed precision drilling and milling of jet compressor castings . . . position automatically to within tenths of a .001"

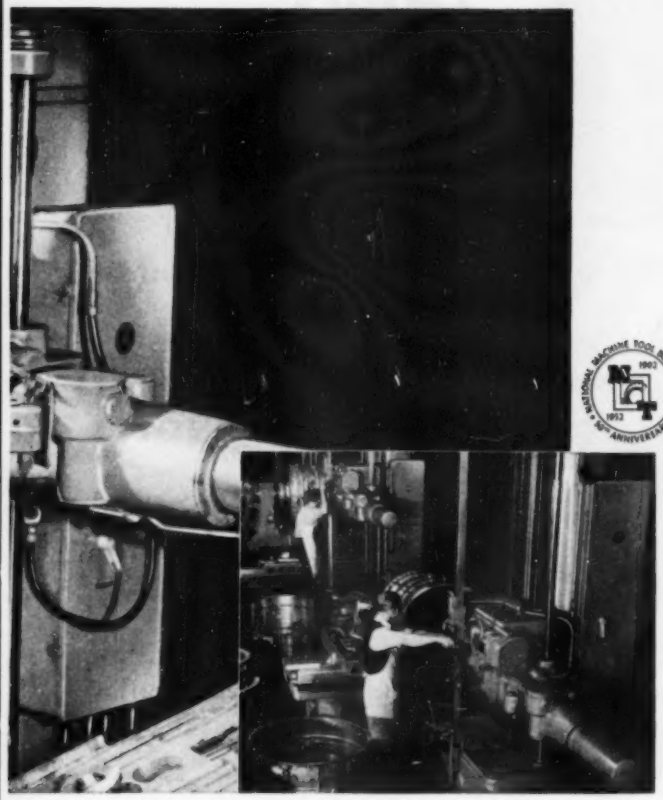
THOUGH complete production data must be withheld for security reasons, A. V. Roe Canada, Ltd., reports three G&L Horizontal Boring, Drilling and Milling machines are making an important contribution toward increased production of the Orenda jet engine.

These machines are equipped with the G&L automatic electric positioning device. This outstanding feature allows fast positioning of the casting accurate to within tenths of .001".

Like A. V. Roe, you too will find that for your work . . . big or small . . . simple or complex . . . you'll save time and money with the G&L line. Maybe you'll want a G&L Horizontal Boring, Drilling and Milling machine—or a G&L Hypro Planer, Planer-Miller or Vertical Boring Mill. But what-


GIDDINGS & LEWIS
Table Type Horizontal Boring Machine
Floor Type Horizontal Boring Machine
Planer Type Horizontal Boring Machine
Hypro Open-Side Planer

extra-close tolerances



Photos show G&L 340-T's working on jet compressor castings. Note small revolving table mounted on standard table which speeds positioning.

ever your need, you can be sure that G&L's unbiased Job Analysis Service will give you an answer that will mean savings. See our nearest representative or write direct. Get the facts about G&L Job Analysis today. There's no obligation . . . and DELIVERY ON G&L MACHINES MIGHT BE BETTER THAN YOU THINK!

G&L 5-POINT JOB ANALYSIS

takes the guesswork out of machine tool buying . . works for you and with you to solve big or complex machining problems..increases production . . reduces machining costs

1 **COMPLETE STUDY OF YOUR JOB OR JOBS** — G&L Job Analysis Engineers, working with your engineers, analyze your requirements by: (1) number and size of parts to be produced (2) number and kind of operations needed (3) tolerances and finishes required.

2 **DETERMINE MOST EFFICIENT MACHINING METHOD** — Taking into consideration the individual machining requirements of the job, G&L Job Analysis Engineers choose the most efficient machining method. G&L engineers can give an unbiased opinion because G&L builds a complete line of sizes and types of planers, planer-millers, vertical boring and turning mills and horizontal boring, drilling and milling machines . . . plus a complete line of accessories and tooling for these machines.

3 **SELECT THE SIZE, KIND AND TYPE OF MACHINE**—The machining method now determined, G&L Job Analysis Engineers — using your production and work requirements — recommend the exact size, kind and type of machine that will do the job most efficiently.

4 **PLAN YOUR OPERATIONS** — After the selection of the most efficient machine to fit your needs, G&L Job Analysis Engineers plan a sequence of operations that will (1) minimize number of setups and setup time, (2) use modern cutting tools to best advantage, (3) take full advantage of the machine working ranges and capacities, (4) keep operator fatigue to a minimum.

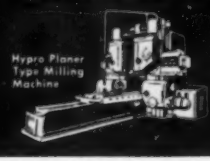
5 **RECOMMEND (AND DESIGN IF NECESSARY) THE TOOLS TO USE** — If conditions warrant, G&L will recommend the standard machine accessories, arrangements and tools you can use to make your equipment more productive—more versatile in application. If special equipment is needed, it will be designed to agreed specifications and made a part of your order.

Write, wire or phone G&L or its nearest representative today. Get the facts on your needs — your problems. Get a G&L unbiased Job Analysis to help you. Don't hesitate — there's no obligation . . . AND DELIVERY MAY BE BETTER THAN YOU THINK!

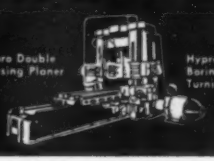
How to get a G&L job analysis

Call your nearest G&L dealer or write us direct. Furnish our Job Analysis Engineers with blueprints, job data, and production requirements. Factory engineers will completely analyze your machining problems. There's no charge, no obligation. Don't hesitate — do it today.

MACHINE TOOL CO.



Hypro Planer Type Milling Machine



Hypro Double Housing Planer

Hypro Vertical Boring and Turning Mill

G&L HYPRO

FOND DU LAC WISCONSIN

Van Keuren

MEASURING ROLLS

are just the thing for the precise measurement of

DOVETAILS
V GROOVES
AND ANGLES

Inspection set No. 17 Measuring Rolls, complete in mahogany case $212.75. Set No. 17 contains 2 rolls each of sizes:—

.050	.0625	.100	.125	.150	.1875	.200	.250	.300
.400	.500	.600	.700	.750	.800	.900	1.000	

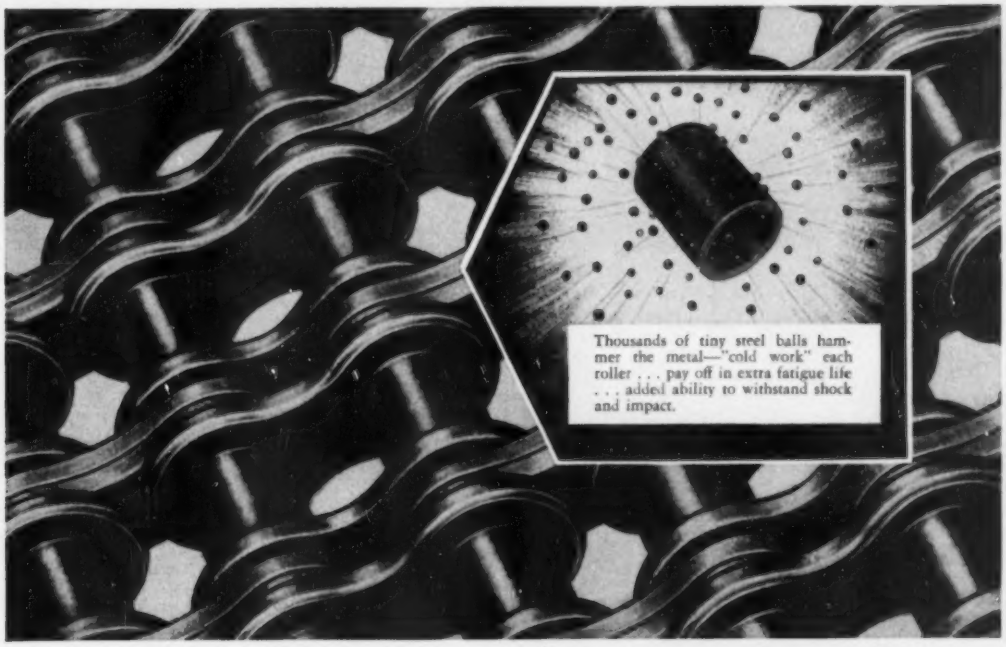
All rolls are 1" long and are guaranteed to be within .00002" for roundness, straightness and exact size.

Complete details on this and other Precision Measuring Tools are given in the Van Keuren 1952 Catalog and Handbook No. 35.

● ***WRITE FOR YOUR COPY***

THE Van Keuren CO.,
33rd YEAR
173 WALTHAM STREET, WATERTOWN, MASS.
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

Get the roller chain that gives you SHOT-PEENED rollers...


Thousands of tiny steel balls hammer the metal—"cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

look for the darkened rollers!

THERE are sound reasons for the universal acceptance of Link-Belt Precision Steel Roller Chain. Two of them—shot-peened rollers and Lock-type Bushings—are shown here.

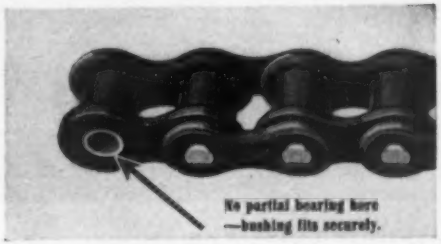
Others include Link-Belt's rigid material selection and controlled heat treating—your assurance of absolute uniformity with no weak members.

Whether it's for drive or conveyor service, you can get the best in roller chain from the complete Link-Belt line—single and multiple widths, in ⅜" through 3", and double pitch, 1" through 3". Next time you need roller chain, call the Link-Belt office near you.

LINK-BELT

PRECISION STEEL ROLLER CHAIN

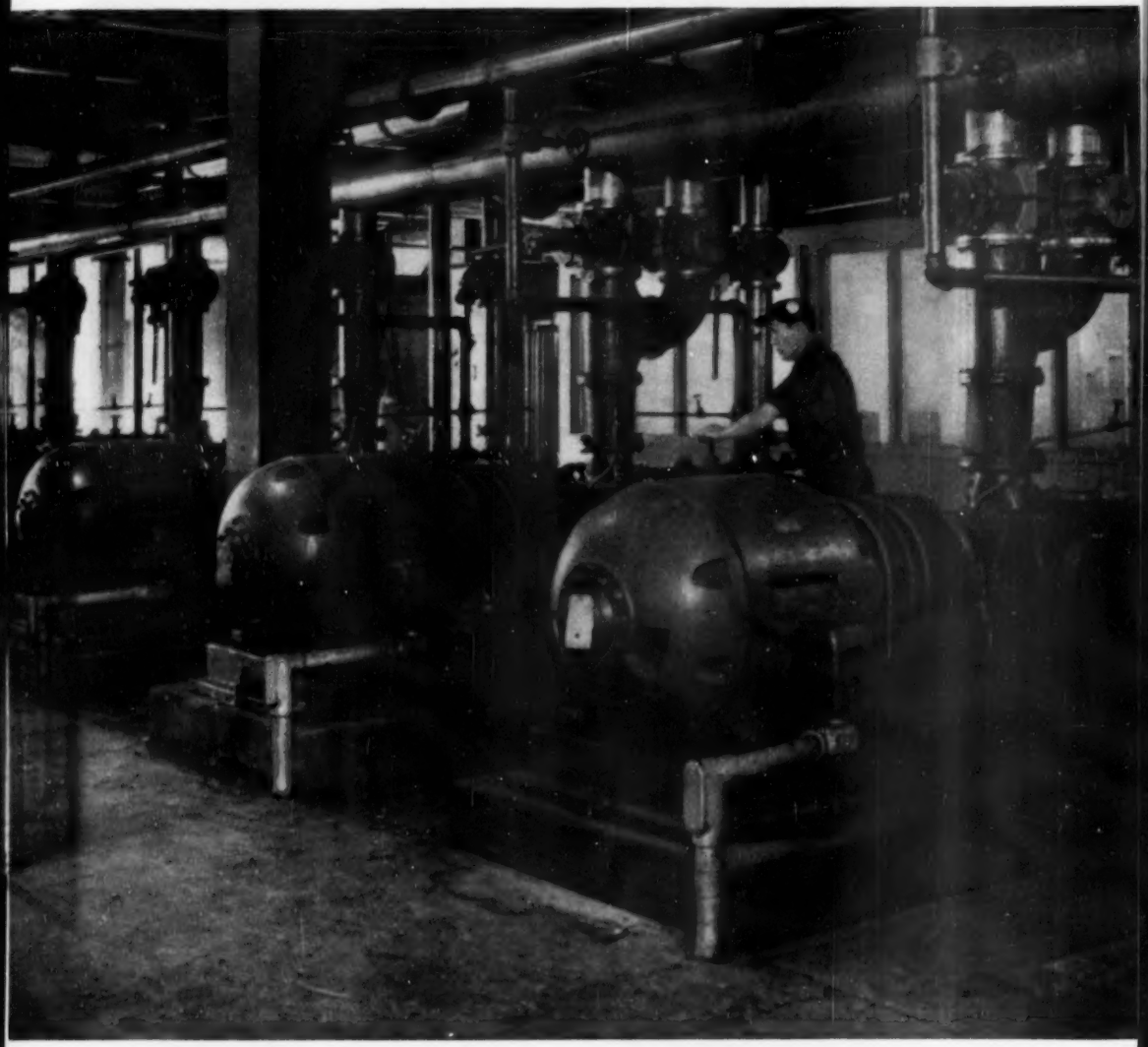
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities. 12,897



Lock-type Bushings increase ability to withstand shock loads

A special manufacturing process securely locks the inside sidebars on the bushing, preventing lateral movement of the sidebars and eliminating a common cause of stiff chains. This Link-Belt development is applied on roller chains through 1" pitch and double pitch roller chains through 2" pitch.

INDUSTRY'S FIRST CHOICE



MASONITE CORP. is among the many big industrial users that prefer Tri-Clad motors for the hard jobs. In fact, 85% of the motors in Masonite's huge West Coast plant are G-E motors. Shown above is part of a bank of 200-hp Tri-Clad motors which drive refiners that brush out the exploded wood chips used in making Masonite boards.

GENERAL ELECTRIC

FOR THE HARD JOBS . . .

TRI CLAD MOTORS

REG. U.S. PAT. OFF.

More than 10,000,000 horsepower of G-E Tri-Clad motors are now serving American industry. This is ample evidence that Tri-Clad motors are industry's first choice for the hard jobs—jobs where uninterrupted production is a must.

Here, for example, are reports from four more industries where G-E Tri-Clad motors are providing superior performance—with minimum maintenance—regardless of today's increasing production demands.

A MOTOR FOR EVERY NEED

In the Tri-Clad motor line, you have the widest selection of standard motors available today: ratings up to 2000 hp; all types of enclosures; gear motors, brake motors, and adjustable-speed drives—plus many other mechanical and electrical modifications to meet your requirements.

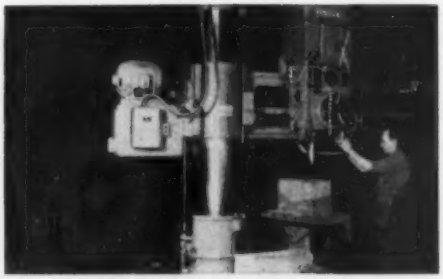
ENGINEERING HELP AVAILABLE

To get top performance from your machines, and to prevent costly shutdowns, G-E engineering specialists stand ready to help you plan your motor applications. And the most complete sales and service network in the motor industry assures you prompt attention to your motor problems.

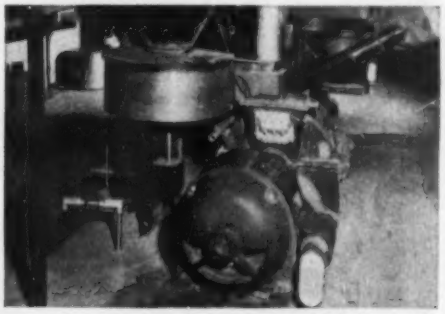
PROMPT DELIVERY

You can get standard G-E Tri-Clad motors right out of stock from G-E shipping points throughout the country. Contact your nearest G-E Sales Office or authorized G-E agent or distributor. *General Electric Co., Schenectady 5, N. Y.*

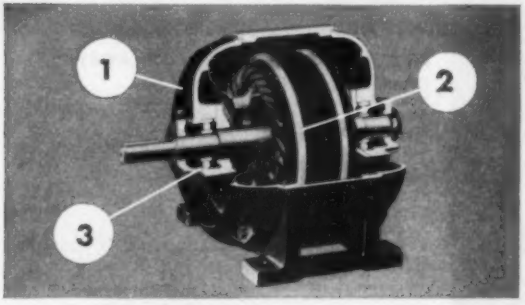
*Reg. trademark of General Electric Co. 752-15



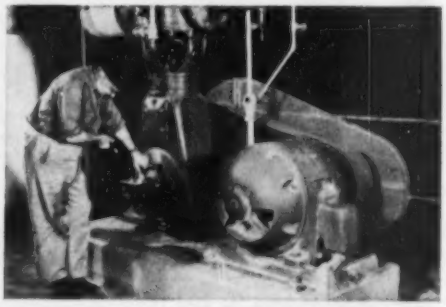
BELL AIRCRAFT CO. uses Tri-Clad motors throughout its plant. The Tri-Clad motor on this heavy radial drill has operated continuously for many years. Plant personnel can't remember a single interruption due to Tri-Clad motor failure!



HERSHEY CHOCOLATE CO. relies on Tri-Clad motors for hard jobs where shutdowns would be extremely costly. This Tri-Clad motor drives a cocoa mill—in continuous operation.

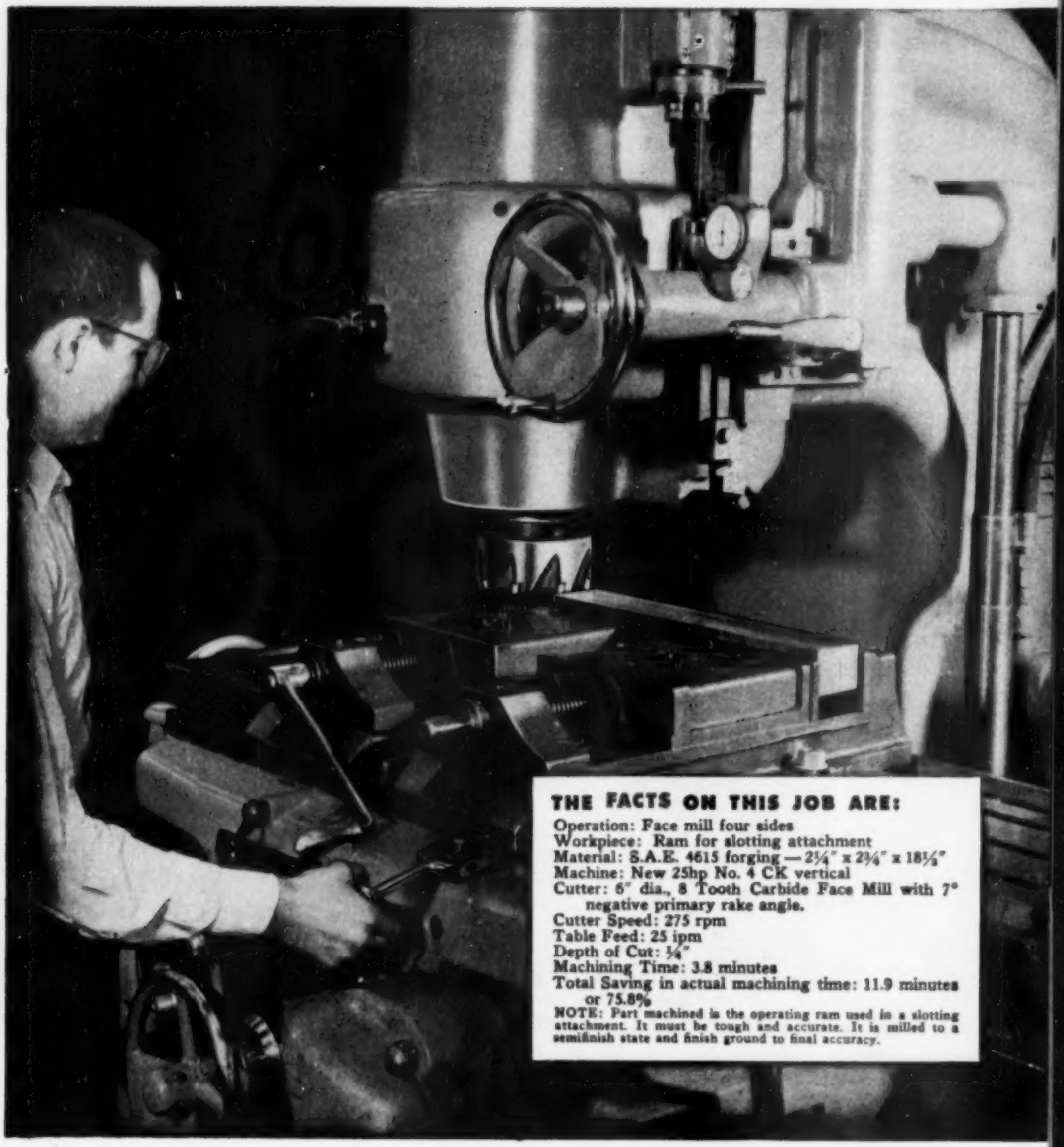


YOU GET TRIPLE PROTECTION with every Tri-Clad motor against . . . . [1]*physical damage*, with rigid corrosion and blow-resistant cast-iron frame; [2]*electrical breakdown*, with G-E Formex* wire which resists oil, heat, moisture, abrasion; [3]*wear and tear*, with completely enclosed bearings that last longer because they can be relubricated if necessary.



AMERICAN CRYSTAL SUGAR CO. reports complete satisfaction with G-E Tri-Clad motors on hard jobs. This Tri-Clad motor provides snappy starting ability needed by the compressor which supplies air to operating equipment throughout the plant, at Moorhead, Minn.

facts tell the story { NEW CUTS



THE FACTS ON THIS JOB ARE:

Operation: Face mill four sides
Workpiece: Ram for slotting attachment
Material: S.A.E. 4615 forging — 2¼" x 2¾" x 18½"
Machine: New 25hp No. 4 CK vertical
Cutter: 6" dia., 8 Tooth Carbide Face Mill with 7° negative primary rake angle.
Cutter Speed: 275 rpm
Table Feed: 25 ipm
Depth of Cut: ¼"
Machining Time: 3.8 minutes
Total Saving in actual machining time: 11.9 minutes or 75.8%

NOTE: Part machined is the operating ram used in a slotting attachment. It must be tough and accurate. It is milled to a semifinish state and finish ground to final accuracy.

KEARNEY & TRECKER MILWAUKEE CK MILLING MACHINE PRODUCTION TIME 75%

4615 ALLOY STEEL FORGING MILLED IN 3.8 MINUTES . . . FORMER TIME 15.7 MINUTES

C-K MILLING MACHINE FEATURES THAT HELP DO THIS JOB BETTER

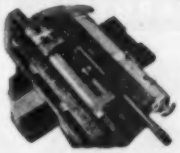
Greater rigidity of new CK column easily absorbed vibration from heavy cutting load. Only single pass needed for each part.

New CK machines have Greater Horsepower. On this job, 25hp permitted operator to get maximum production from his modern cutter.

CK's 3-bearing spindle and flywheel assured Maximum Cutter Efficiency. On this job, it meant fast metal removal and excellent finish in a single pass.

The new Kearney & Trecker CK milling machine on this job has 24 different spindle speeds (13 to 1300 rpm). Its 32 different table feeds range from ½" to 90" per minute. Operator was able to pick proper *speed and feed* — to take full advantage of high horsepower and modern tools. The result — Greater Productivity on this job.

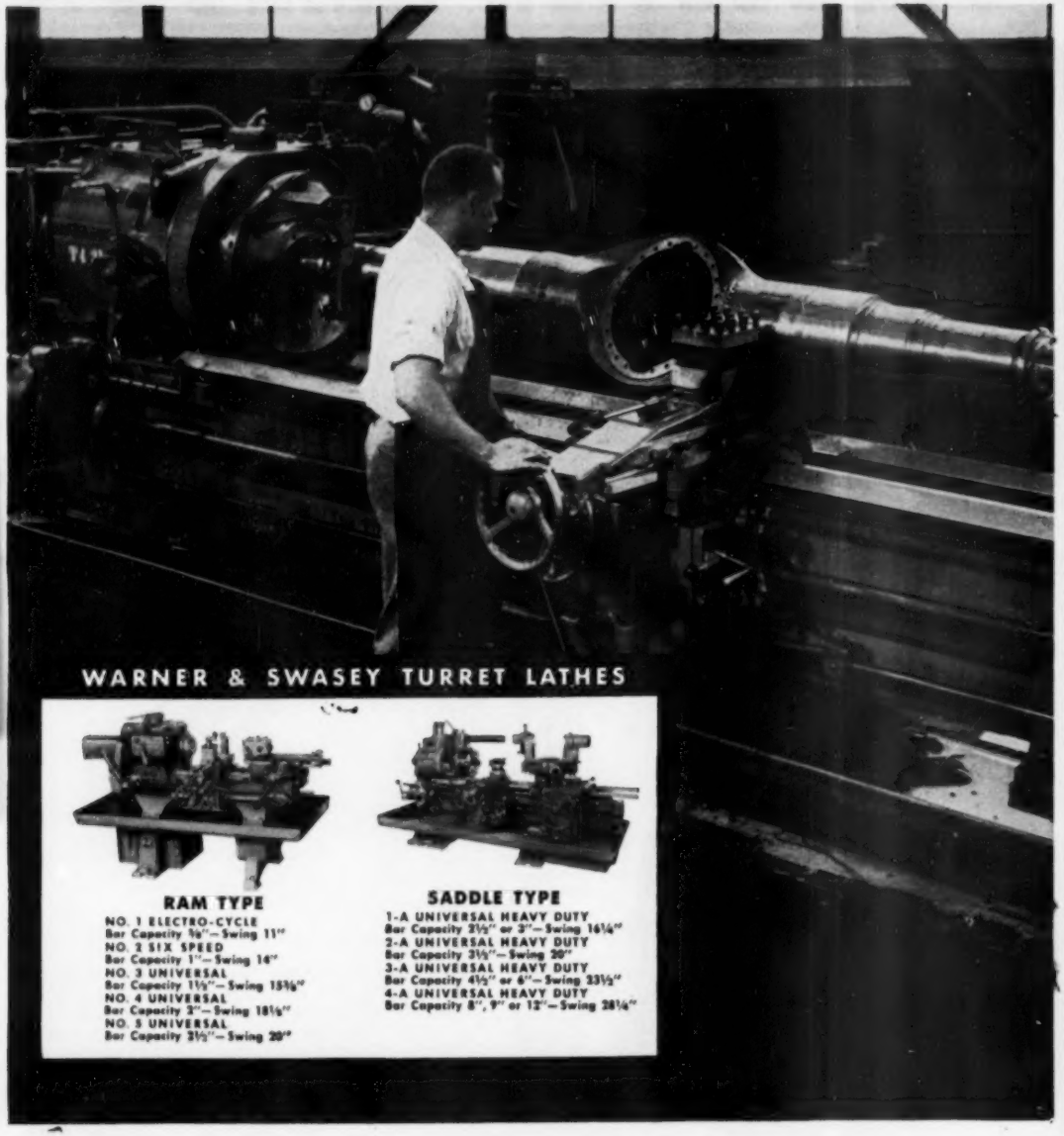
CK's new heavy duty (2" dia.) table feed screw gives greater bearing contact for smoother feed performance and sustained accuracy.



CK's positive lubrication plus generously proportioned gears and shafts assure cool, trouble-free operation under heaviest load conditions.

It will pay you to see the new CK line of milling machines — check them against your own requirements. You'll notice how every feature is designed and job-proven to give you cost-cutting results—greater machine capacity, productivity and better finished products. So, for the full story, contact your nearest Kearney & Trecker representative or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

"KING SIZE" OR



WARNER & SWASEY TURRET LATHES

RAM TYPE

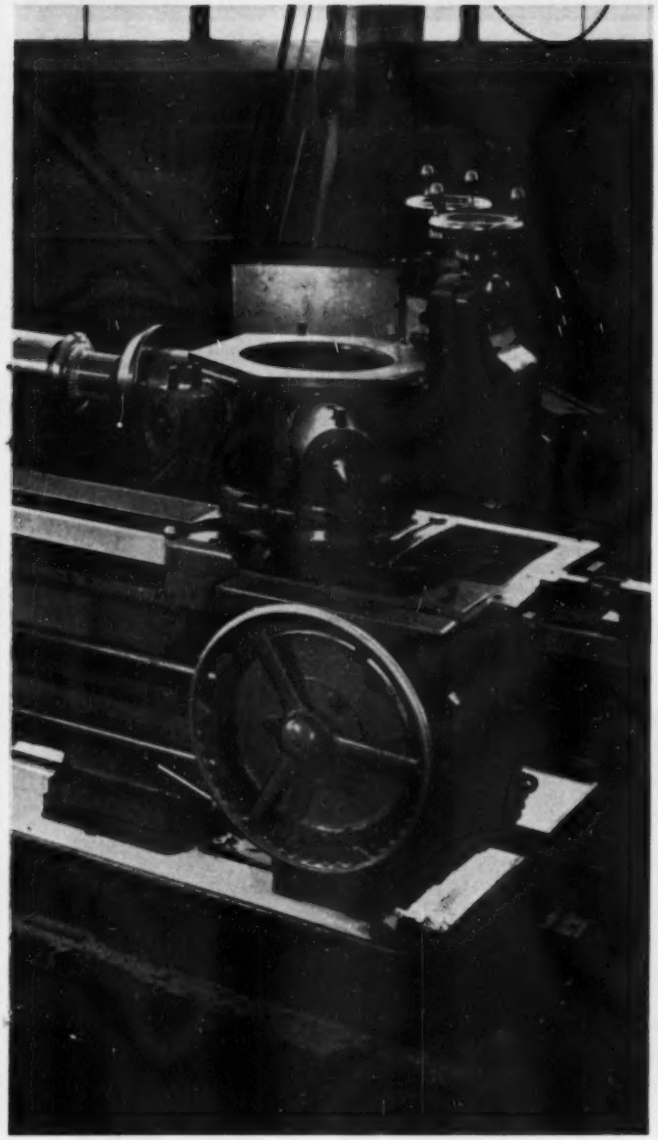
NO. 1 ELECTRO-CYCLE
Bar Capacity 1⅛"—Swing 11"
NO. 2 SIX SPEED
Bar Capacity 1"—Swing 14"
NO. 3 UNIVERSAL
Bar Capacity 1½"—Swing 15⅛"
NO. 4 UNIVERSAL
Bar Capacity 2"—Swing 18⅛"
NO. 5 UNIVERSAL
Bar Capacity 2½"—Swing 20"

SADDLE TYPE

1-A UNIVERSAL HEAVY DUTY
Bar Capacity 2½" or 3"—Swing 16¼"
2-A UNIVERSAL HEAVY DUTY
Bar Capacity 3½"—Swing 20"
3-A UNIVERSAL HEAVY DUTY
Bar Capacity 4½" or 6"—Swing 23½"
4-A UNIVERSAL HEAVY DUTY
Bar Capacity 8", 9" or 12"—Swing 28¼"

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

"REGULAR" WARNER & SWASEY OFFERS BOTH



● This Warner & Swasey in the plant of a large road machinery builder is a good example of what we mean when we say Warner & Swasey Turret Lathes are built in sizes and capacities to handle all sorts of jobs. This machine, a 4-A Universal Heavy Duty Saddle Type Turret Lathe, has a bed six feet longer than standard in order to turn the "king size" rear axle housings used in the giant roadbuilding machinery. And tolerances of .001" are held on these large pieces.

When you buy a Warner & Swasey—whether it's to handle the ⅝" bar capacity work of the No. 1 E-C, or jobs requiring the 12" bar capacity of the big 4-A—you buy a machine with an industry-wide reputation for ruggedness and extreme precision. It's a machine you can count on for high productivity, low upkeep, ease of operation, and dependability in holding its built-in accuracy for many years ahead.

So whenever you have a turning problem, call in your nearest Warner & Swasey Field Representative. He'll work with you and recommend the right machine for your range of work.

WARNER & SWASEY
Cleveland

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

"We expect a lot from

Here, springs and cups are made up into complete spring assemblies . . .

Then the springs are fastened to the bottom of the shipping crate . . .

And the typewriter base is secured to the shipping crate bottom . . .

Then the entire unit is crated. Springs are the only cushioning used.

these American Springs"

says UNDERWOOD CORPORATION, world famous typewriter manufacturer

UNDERWOOD is so quality-conscious that they use a spring-cushioned packing crate for every typewriter shipped out of the country.

"These cushion springs have to be good," says Underwood, "because we use no other protective cushioning. Spring failure might result in broken castings, and delicate adjustments would certainly be thrown out of kilter. It would entail the costliest of repair jobs."

But Underwood has been using essentially the same American Quality Springs for over 40 years, and complaints are so rare that they are negligible. This is real spring service, especially when you consider that the typewriter goes by truck and rail to a shipping port, then is loaded aboard a freighter, unloaded, then shipped by rail, truck or, in some countries, very frequently *donkey cart* to some interior town.

As Underwood puts it, "The cushion springs must absorb unbelievably rough handling, jostling and drops. But we have a good reputation for damage-free arrivals."

Why not consider tough American Quality Springs like these for *your* product? We are prepared to furnish any size, any grade of steel, any quantity. And if you are contemplating a new design, call in our spring design engineers now. They've encountered just about every problem in the history of spring-making; and they'll be sure to give you a quality spring at a cost you never thought possible. Call your nearest District Sales Office or write to American Steel & Wire Division, Rockefeller Building, Cleveland 13, Ohio.

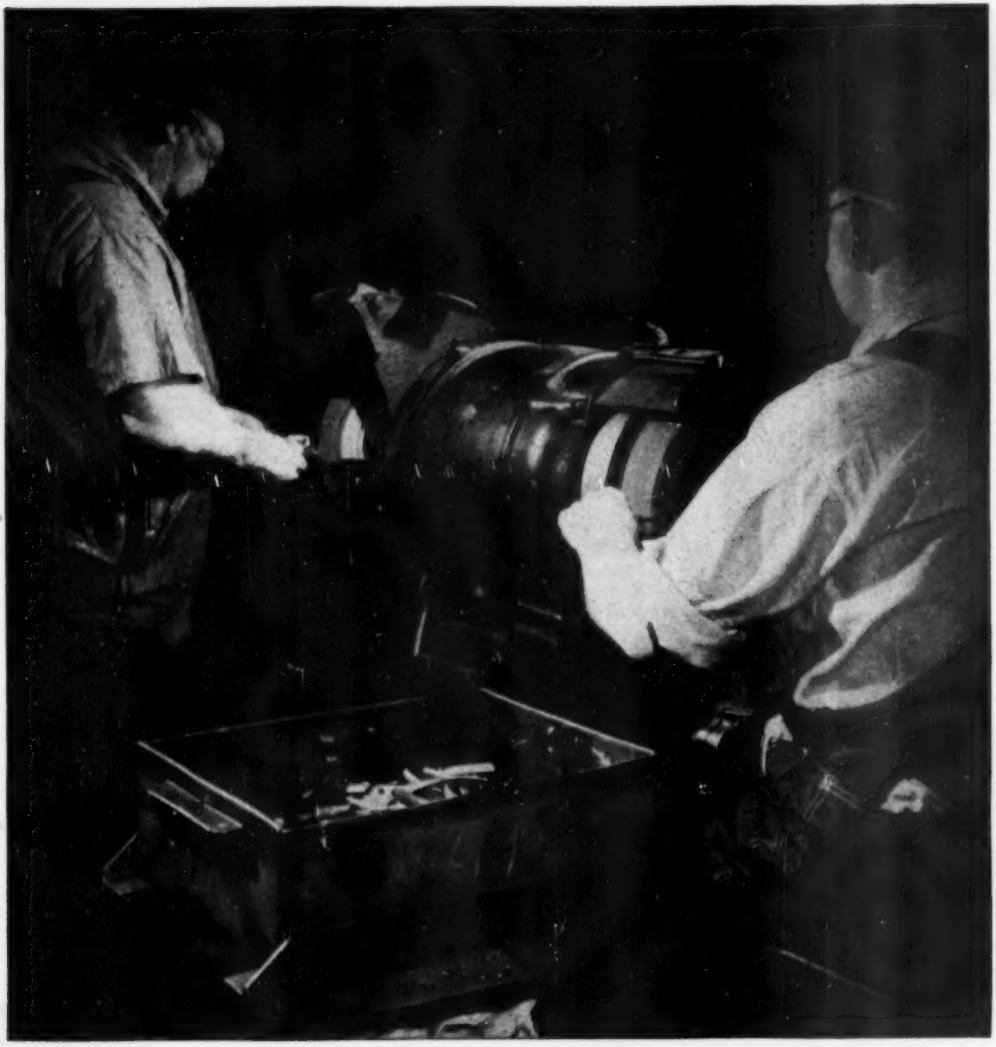
AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S American Quality Springs

UNITED STATES STEEL

TO CUT COSTS ...ever think of



Only CARBO

TRADE

"Carborundum" is a registered trademark which indicates a manufacture by The Carborundum Company, Niagara Falls, New York.

switching to an abrasive BELT?

Grinding and polishing techniques have undergone major improvements in the past few years. One of many revolutionary developments is the "61" contact wheel, used with a coated belt on many operations previously performed with a bonded or a set-up wheel. In every case, the change has been made for just one reason —to yield a better result at a lower cost.

This is the kind of change that spells progress to every metalworking man who is battling against higher and higher costs. And this is the reason why you should welcome the CARBORUNDUM man or distributor salesman when he calls on you. There is nobody quite like him, for he's not in the position of having to back just one type of product, or two. He alone has the ability to help you specify the one RIGHT combination of abrasive product and abrasive method for every operation in your shop.

His counsel is experienced, practical, and above all completely free from bias—for he represents the only complete line of abrasives, from CARBORUNDUM, the world's best known brand name in abrasives. We suggest that you call him in today— it's to your profit!

Here are only a few of the 30,000 reasons why you get the RIGHT combination of abrasive and method only from CARBORUNDUM

RUNDUM

MARK

offers ALL abrasive products...to give you the proper ONE

How to maintain quality standards in today's expanding production

Johansson

GAGE BLOCKS

In precise measurements — as laboratory standards, or for regular checking of tools and gages — you can insure exacting accuracy and guard against costly rejects by equipping each department with Johansson Gage Blocks. Even with today's need to expand production, you can maintain established quality standards by adding Jo-Block protection whenever you add new men or machines.

Jo-Blocks are made in 3 guaranteed accuracy standards: ±.000002", .000004", and .000008" per inch. Many accessories extend their usefulness. Write for catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

Brown & Sharpe JBS

"CATERPILLAR"

+

"American"

A coalition of outstanding "name" products dedicated to the interests of industry.

Here is a "Caterpillar" Diesel DW20 Tractor with W20 Wagon loading heavy clay for the Garza-Little Elm Dam near Lewisville, Texas.

The astonishing ease of operation of these units due to their ultra-modern design makes the "load" lighter and the cost lower.

For the very same reason "Caterpillar" uses many "American" Radials. Because of their ultra-modern design they make the drilling, boring and tapping "load" lighter in "Caterpillar" plants and keep the cost of production at a minimum.

Extra power, centralized control, boring mill type spindle and extra fast tapping are outstanding virtues of "American" Hole Wizard Radials which swell the operator's pay envelope and help keep production on a profitable plane.

For more work, better work and lower cost work, get the facts about "AMERICAN".

Bulletin No. 327 upon request.

THE AMERICAN TOOL WORKS CO. Cincinnati, Ohio U.S.A.

Finis

Increased HONOL!

—Wisconsin Motors Corp.

The Wisconsin Motors Corp., Milwaukee, makes small, precision-built, air-cooled engines. In honing the cylinder bores, operators were getting unsatisfactory results. Stones were loading and glazing and cylinder blocks heated excessively, resulting in distorted bores, scratched surfaces and necessitating considerable reworking.

Then the shop replaced the fluid in use with Sinclair HONOL.® This specially developed honing oil so reduced loading and glazing of the stones and the build-up of excessive heat, that size control was immediately improved. And with HONOL, stone life was prolonged, finish was greatly improved and, *most important of all*, the need for re-working many cylinders was eliminated. It is now rare for Wisconsin Motors to have any honing problems.

There is a grade of Sinclair HONOL for every honing requirement. It can improve finish, speed production . . . *save money*. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR CUTTING OILS and COOLANTS

—for metal working

Fast Motor Service Wherever You Are

"Certified"

Factory approved motor service in every industrial area from 97 Allis-Chalmers Certified Service Shops.

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Montgomery—Standard Electric

ARIZONA
Bisbee—Copper Electric Co. Inc.
Phoenix—Daley Electric Company

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COLORADO
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York—Industrial Electric Company

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Of course, Allis-Chalmers Certified Service Shops give good service on any electrical equipment, of any make. Tear out this ad and save it, or write the name of the A-C Certified Service Shop nearest you in your address book. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3864

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ½ in. to 72 in. discharge and up.

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ELMIRA, N.Y.

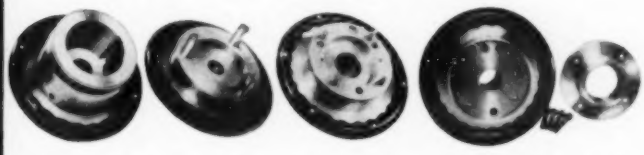
COLLETS for LATHES and MILLING MACHINES

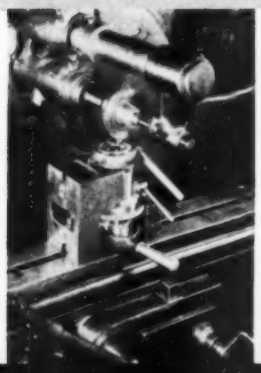
Precision work requires precision collets. HARDINGE collets assure you of all-essential accuracy plus durability, because they are hardened and ground both internally and externally, and have heat-treated threads.

HARDINGE-SJOGREN SPEED Collet Chucks

Increase machine capacity 25% to 40% with the fast action of a handwheel-operated HARDINGE-SJOGREN Speed Collet Chuck. Let your operators get the full use of your tool room lathes, engine lathes and grinders.

Five sizes: 1", 1 3/8", 1 3/4", 2 1/4", and 3 1/2" Collet Capacity; Threaded, Tapered Key-Drive, Cam-Lock, and American Standard Spindles.

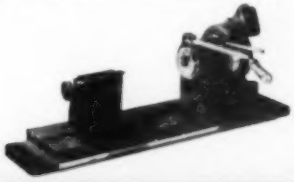




HARDINGE COLLET INDEX FIXTURES

The way to increased production is to hold work accurately and provide for rapid indexing. HARDINGE Collet Index Fixtures—H-4 for Tool Room and Inspection Departments; HV-4 for Production Departments—will help increase production on either new or old machines. Planned interchangeability for a variety of applications. Buy these standard fixtures instead of making expensive special fixtures.

H-4

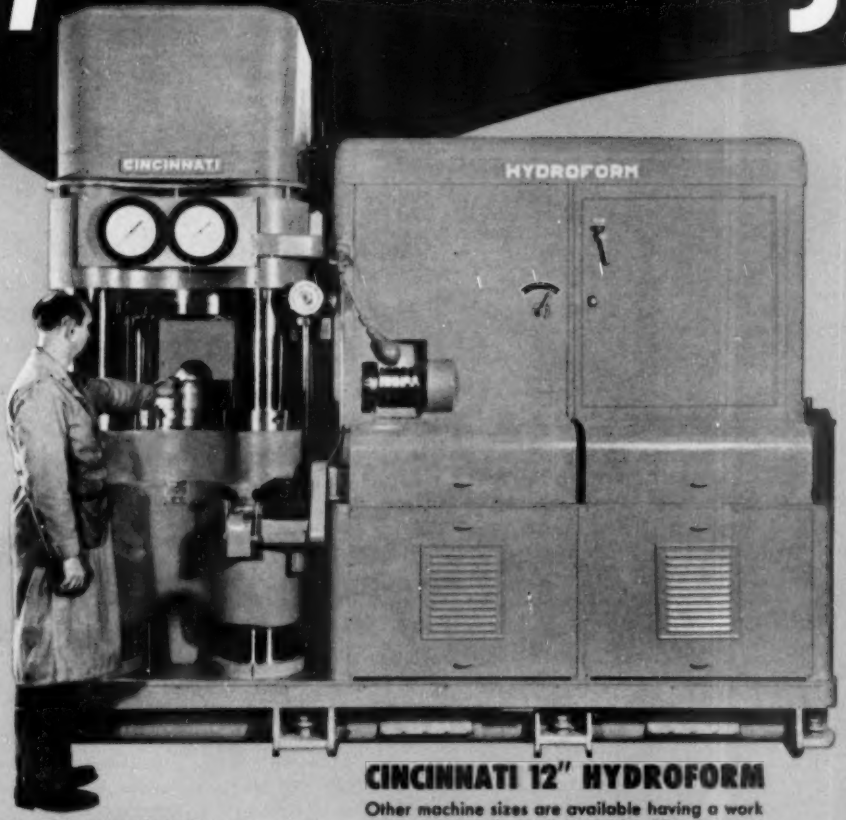


HV-4

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Hydroforming

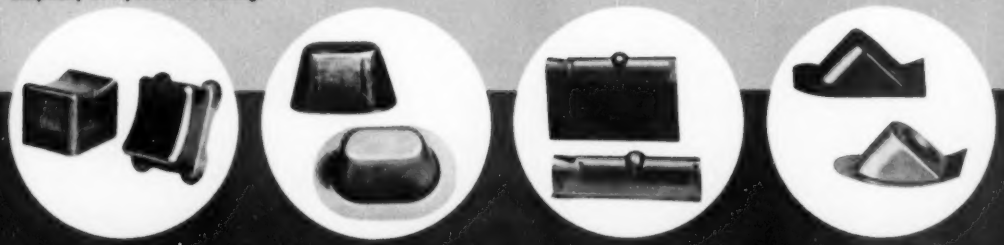


CINCINNATI 12" HYDROFORM

Other machine sizes are available having a work capacity (max. blank dia.) of 19", 23", 26" and 32". Information on machines of larger capacity furnished on request.

EASY-TO-PRODUCE MALE PUNCHES MATERIALLY REDUCE TOOL COSTS

Shown below are typical examples of the simplicity of Hydroform tooling.



cuts the cost of tooling for deep draw work

TOOL COSTS CAN RUN AS LOW AS 10% OF CONVENTIONAL DIE SET COSTS!

Hydroforming is deep drawing by use of a male punch working upward into a *flexible die member* . . . a built-in feature of the Cincinnati Hydroform that replaces *more than half* the parts of the conventional draw die.

Hydroform tooling consists simply of a punch of the desired shape, and a draw ring contoured to fit around the punch. Normal clearance between the punch and draw ring is 50% or more of the thickness of the material being formed—eliminating a costly die-maker's fit.

Punches can be made of untreated steel, cast iron, hard woods, Kirksite, brass, aluminum, or other easily worked materials, depending on the quantity and shape of the part. Punch maintenance is minimized as the cushioned action of the flexible die member reduces punch wear.

The tools are self-centering and easy to locate in the machine. Set-up and changeover of tooling is accomplished rapidly.

Low cost tooling is a major Hydroforming advantage. However, Hydroforming brings to deep drawing *many* other benefits:

- Most parts can be produced in a single draw—eliminating multiple operation processing.
- Practically any shape can be formed from a wide variety of materials up to steel ⅜" thick.
- Part quality is materially improved. Surface finish is unimpaired.

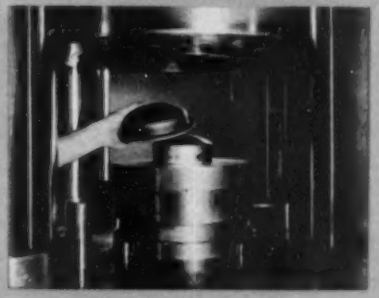
Investigate Hydroforming now. It will change your thinking on deep drawing and forming! Call in your nearest Cincinnati Milling Machine Co. field engineer for a factual discussion of how Hydroforming can cut the cost of your metal forming work. For detailed information on Hydroform machines and the Hydroforming principle, write for Bulletin M-1759.

CINCINNATI

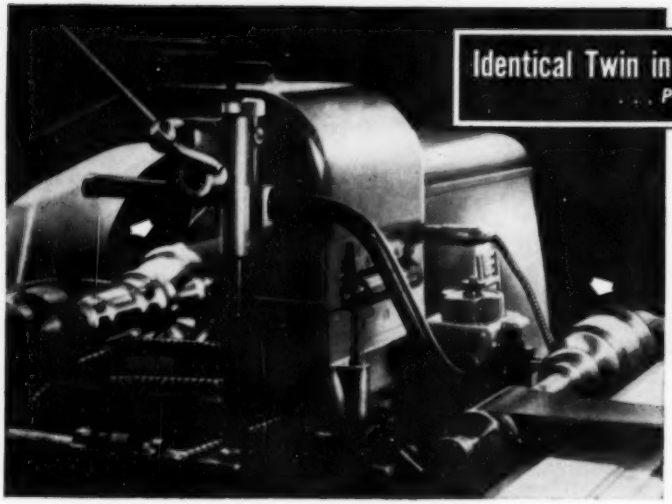
PART DRAW RING PUNCH

Shown above are the basic elements of Hydroform tooling—a draw ring and punch.

A close-up view of tooling installed in the Hydroform is shown below. Only 7½ hours were required to produce the draw ring and punch from mild steel. The part shown is a high pressure vessel cap of ¼" mild steel, Hydroformed in one operation.



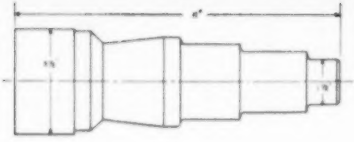
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

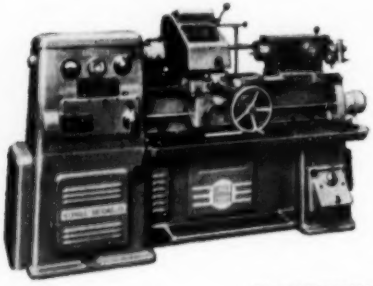


Identical Twin in Less than Four Minutes

. . . Produced on the

HIGH SPEED HYDRAULIC COPYING LATHE





Examine this miracle of modern engineering made possible by the H.E.B. High Speed Hydraulic Copying Lathe. Pictured at the right is the turned master; at the left you see its identical twin — a shaft of S.A.E. 4130 steel accurately copied in just 3¾ minutes. That's breath-taking speed for such precision finish.

The H.E.B.'s patented tracer device is built into this ruggedly constructed lathe. There are no troublesome attachments, and *setting time takes no more than 10 to 20 minutes.* Experience on production lines proves time and again that finished parts are copy-turned up to 300% faster than on multi-tool lathes!

With its 20 H.P. motor the **OP Model** takes heavy cuts with carbide tools at spindle speeds 50 to 3600 RPM. **GT Models** with rotating pattern are designed for copying an infinite variety of irregular, non-circular work.

More than 1000 of these modern copying lathes are now in use worldwide . . . designed and built in France by H. Ernault Batignolles, manufacturers of machine tools for almost a hundred years.

Catalogs on both of these machines, including complete specifications, are available upon request. Write or telephone now for catalog or demonstration.

TYPE 178 CONSTAN CARBIDE TOOL GRINDER

The Constan Grinder is specially designed for sharpening carbide tools, etc., without attachments . . . lengthens their life and improves cutting capacity. Heavily built, the Constan combines smooth operation and ease of setting with great rigidity. The inclinable table incorporates a ball and socket vise so that the tool may be clamped in any position. Two diamond wheels — one for roughing and one for finishing — are mounted on the wheel head, and each may easily be brought into position. The machine may also be used for sharpening milling cutters.

H·E·B

"THE WAY TO TURN"

IMMEDIATE DELIVERY

H. E. B. MACHINE TOOLS, INC.

475 FIFTH AVENUE, NEW YORK 17, N. Y.

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COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • TOOL ROOM LATHES • CARBIDE TOOL GRINDERS

ALL TOP PERFORMERS
...ALL 100% INSPECTED
...ALL BUTTERFIELD!

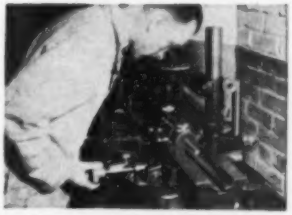
Taps, Dies, Reamers, Screw Plates . . . and now Twist Drills . . . round out the cutting tool line that gets industry's unqualified approval for uniform accuracy and long, trouble-free service. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

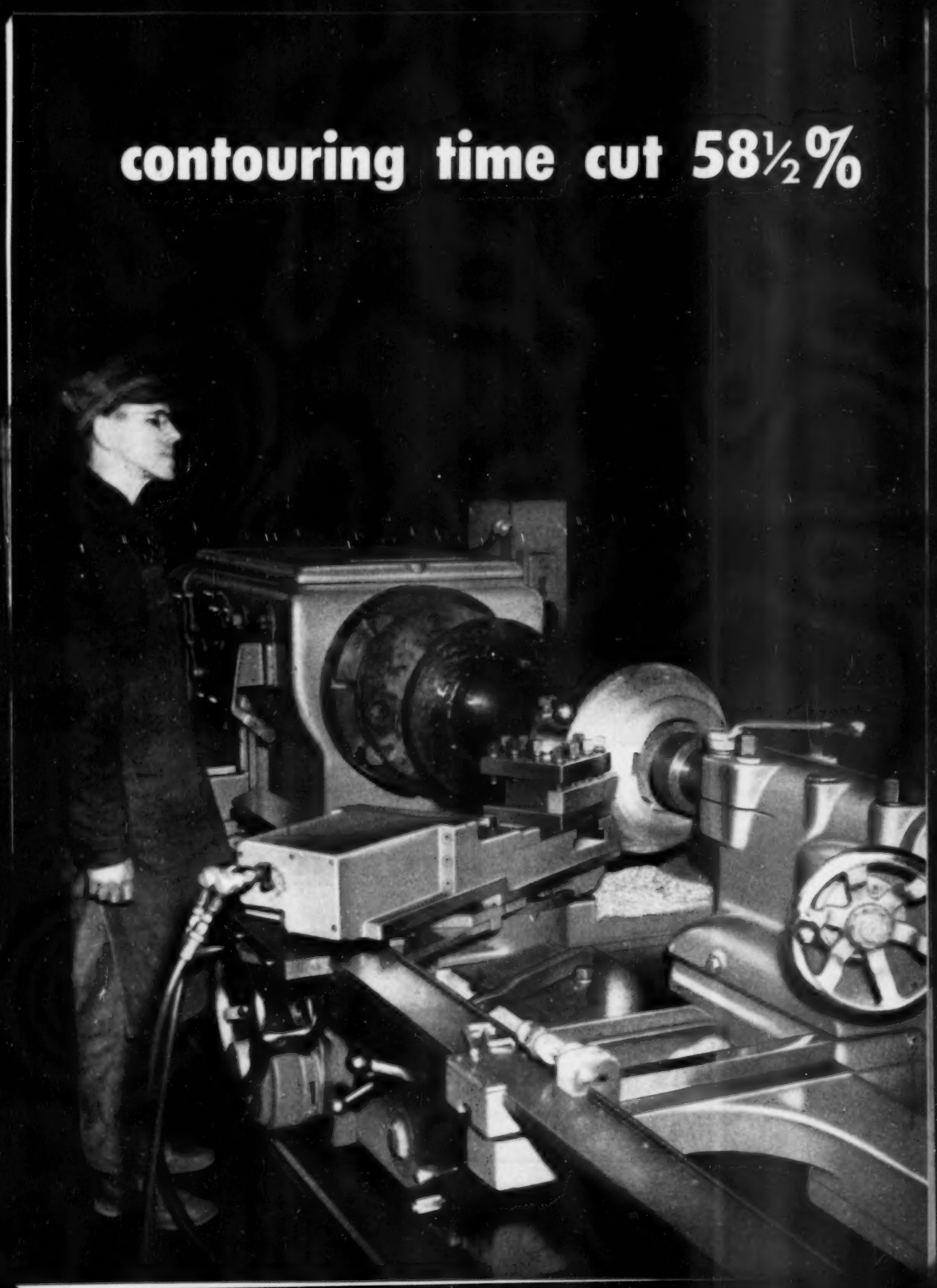
TAPS • DIES • REAMERS • SCREW PLATES • TWIST DRILLS



Checking pitch diameter, thread form and lead on a Zeiss Universal Measuring Microscope.

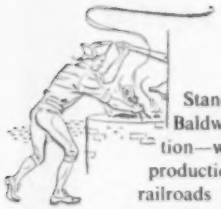
SEE YOUR NEARBY BUTTERFIELD DISTRIBUTOR FOR PROMPT DELIVERIES AND SERVICE

contouring time cut 58½%



with LeBlond Hydra-Trace

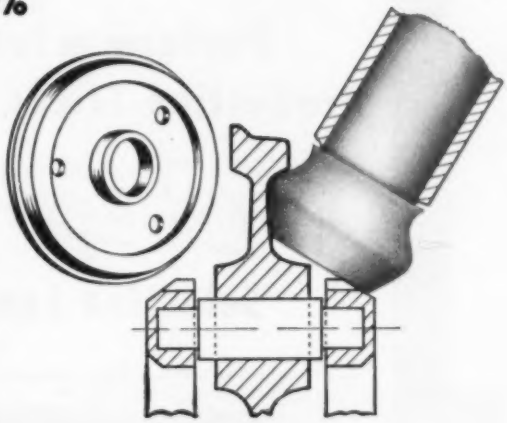
wheel mill roll life boosted 50%



Standard Steel Works Division of Baldwin-Lima-Hamilton Corporation—whose forges first flamed into production in 1795—supplies America's railroads with one-piece, wrought steel car and locomotive wheels. And Standard Steel officials credit LeBlond Hydra-Trace for contributing to their outstanding success in producing these wheels at competitive cost in the quantities needed.

At Standard's Burnham, Pennsylvania Works, rolls of alloy steel are turned to contour and then put to work shaping wheels. The intense pressure and heat of this hot-rolling operation soon work-hardens and wears the rolls out of contour. Formerly a skilled operator—tediously matching contours with a hand-held template—redressed the rolls manually. Four dressings were considered long service for a roll . . . and the work-hardened surface quickly dulled carbide turning tools.

Now, with Hydra-Trace installed on a 25" LeBlond Heavy Duty Lathe, Standard Steel chalks up big savings under all three headings—man hours, material and tool life. As Marty Gotwalt of Swind Machinery—LeBlond's Philadelphia distributor—puts it, "Hydra-Trace automatically keeps the tool just under the work-hardened skin. We've lopped 14 hours off what used to be a 24 hour job."



And that's not all. Minimum metal-removal by the Hydra-Trace method frequently saves Standard's wheel mill rolls for six dressings—*a bonus of two over the manual method.*

Whether your turning problems—like the wheel mill rolls at Standard Steel—center in the toolroom or demand stepped-up output on the production line, Hydra-Trace is ready to help. For all LeBlond Heavy Duty Lathes built since 1935, this template-controlled, hydraulically powered tracer can be mounted in minutes. Templates are flat, compact, and suitable for both rough and finish turning. Call your LeBlond distributor or write

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

Ask for Bulletin HT2A for complete details on LeBlond Hydra-Trace

turned faster by LeBLOND of Cincinnati

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 64 YEARS*

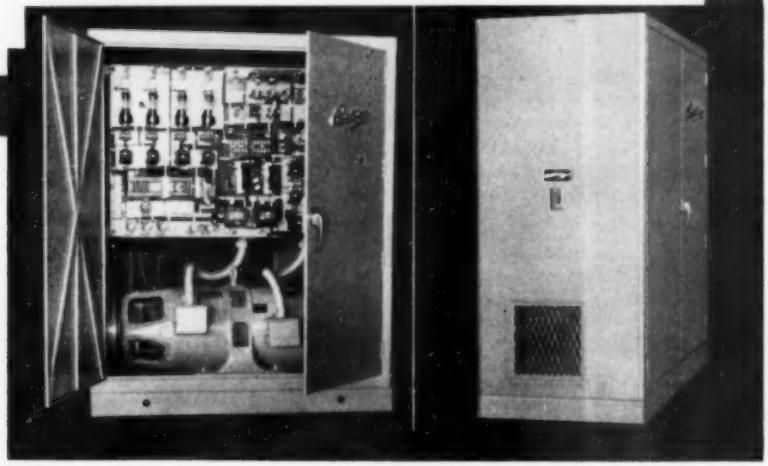
Perform a lot of "*Pay Off*" Production Tricks with this Versatile

Century

Selective Speed Drive

POWER UNIT — Inside front view showing control and motor generator set.

Side view of power unit showing air cleaner for forced air ventilation.



Century Motors and Generators
A.C.-D.C.—⅛ to 400 H.P.

CENTURY ELECTRIC
1806 PINE STREET • ST. LOUIS 3, MISSOURI

●You can instantly dial the OPTIMUM carbide tool cutting speed for any diameter of work or class of material.

●For repetitive production, you can automatically control the correct OPTIMUM pre-set cutting speeds for two or more diameters.

●Also for repetitive production you can automatically control the OPTIMUM carbide tool cutting speeds for all the varying diameters of a facing operation.

●You can perform a continuous, closely controlled process on flat or round material:

1. With a wide range of speed adjustments to suit various material sizes and processes.
2. You can feed the material through the process with a pre-selected automatically controlled constant speed, while the material is unwound and rewound on the continuously varying diameters of the spools which hold the processed material.

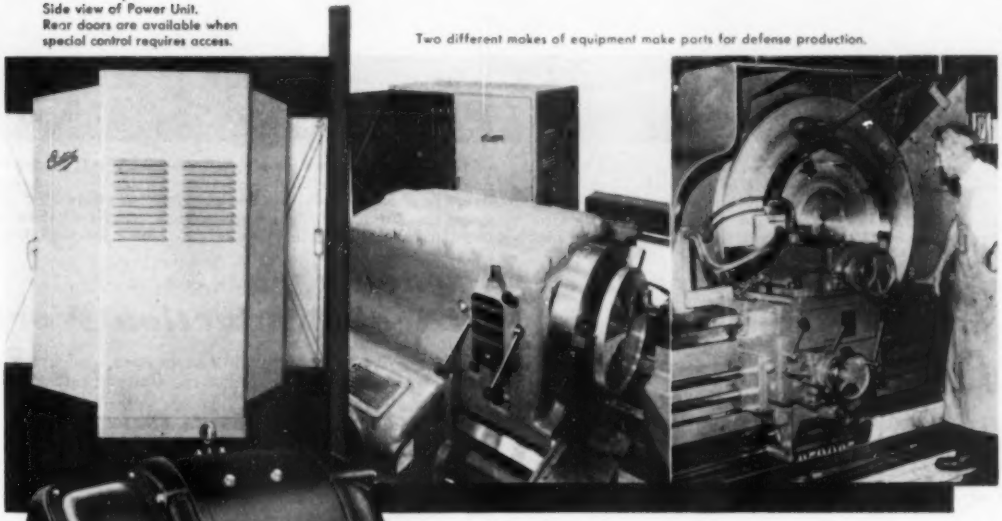
●You can accurately control assembly line conveyors over a wide range of speeds, and precisely coordinate the speed and timing of feed conveyors.

●You can: (1) inch the load . . . (2) accelerate the load fast or slow . . . (3) stop the load quick or slow . . . (4) stop and start at a controlled pre-set speed . . . (5) reverse the load under specific conditions . . . and (7) you can use a multiple of co-ordinated drives for related functions.

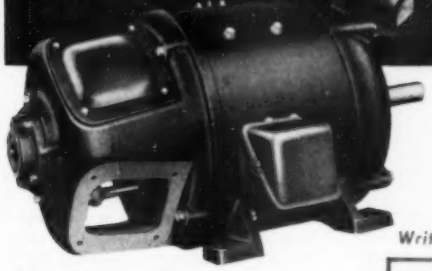
●Because of the minute amount of control current required for handling large horsepower, many forms and shapes of control devices are available with this most versatile Century Selective Speed Drive. These pilot controls can often be mechanically interlocked in the driven machine to direct specific functions.

A Century motor specialist will be glad to discuss with you the specific benefits you can get from Century Selective Speed Drives. They may be adapted to your present — or new — production equipment.

Side view of Power Unit. Rear doors are available when special control requires access.



Two different makes of equipment make parts for defense production.



Typical drive motor which operates from the alternating current power unit.

The OPTIMUM cutting speeds are automatically controlled to provide a uniform cutting speed for all the varying diameters of the facing operation.

Write . . . ask that a Century application engineer consult with you.

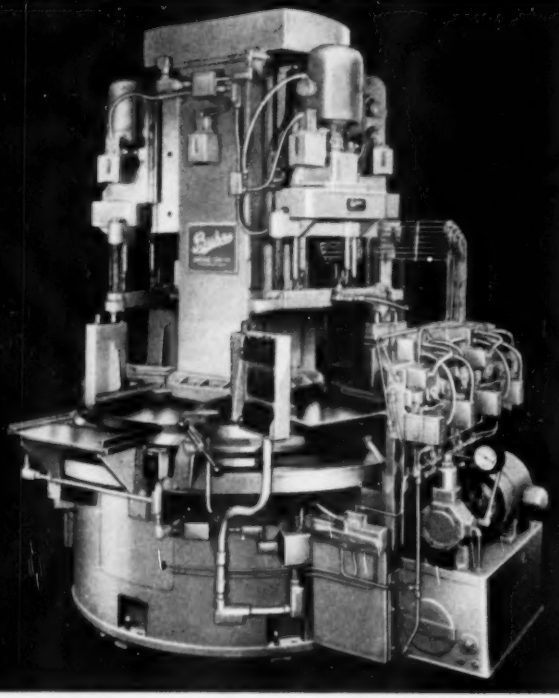
COMPANY

Century MOTORS

Offices and Stock Points in Principal Cities

CE-756

THANKED FROM TOKIO TO TEMPLEHOF!



Aircraft Pilots . . . from Tokio Airport in Japan to Templehof Airdrome in Berlin . . . are grateful for such Production Stalwarts as this Buhr 5-Station Hydraulic-Feed Center-Column Special Machine . . . which is now working the clock around . . . helping to turn out Cylinder Heads for one of the world's largest manufacturers of aircraft engines—engines on whose reliability pilots consistently stake their lives! Is it any wonder that some of these pilots . . . who know the fundamentals of production . . . say "thanks" to such Special Machinery as this . . . for a job well done?

Aviation Industries Rely on Machinery Like This for Critical Production Work

For making such a critical product as a large aircraft engine, Uncle Sam chose one of the world's best-known engine manufacturers. Volume Production . . . of the highest quality . . . had to be set up as quickly as possible.

One of Their Problems

To drill and ream the holes in the Cylinder Heads of this particular aircraft engine—that was one of their problems.

To handle this important phase of their production, they called in Buhr.

What the Machine Does

In general—this Five-Station Hydraulic-Feed Center-Column Machine with 72" Automatic Index Table . . . drills and reams (6) holes in Rocker Arm Pockets in Cylinder Head of Aircraft Engine...handling four parts at a time.

Specifically, the Machine accomplishes this—

Station 1—Load and unload
Station 2—Drills (2) 1" dia. holes
Station 3—Drills (2) $^{23}/_{32}$" dia. holes
Station 4—Drills (2) more 1" dia. holes
Station 5—Reams (2) .750" dia. holes

PRODUCTION—50 parts per hour at 100% efficiency.

Why Buhr Was Chosen

In the Aviation Industry . . . as in many others . . . Buhr has served leading manufacturers for many years—some for more than a quarter-century! They have come to rely on Buhr whenever they need machinery for critical high-volume production. They know that Buhr has excellent manufacturing facilities . . . that their sales, engineering and production staffs are trustworthy and experienced, specialized in this kind of machinery, and available anywhere in the United States.

For Details About Buhr

A comprehensive Catalog . . . or a personal call from a Buhr Sales Engineer . . . is yours for the asking. For every problem involving this type of Special Machinery—including the type that's "thanked from Tokio to Templehof"—phone, wire or write us.

BUHR MACHINE TOOL CO.
Ann Arbor, Michigan
Phone: Ann Arbor 2-5646—5980
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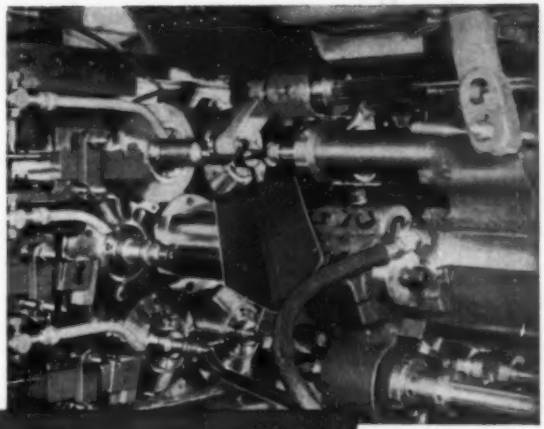
Buhr ***SPECIAL MACHINERY...Leaders Make Sure With BUHR***



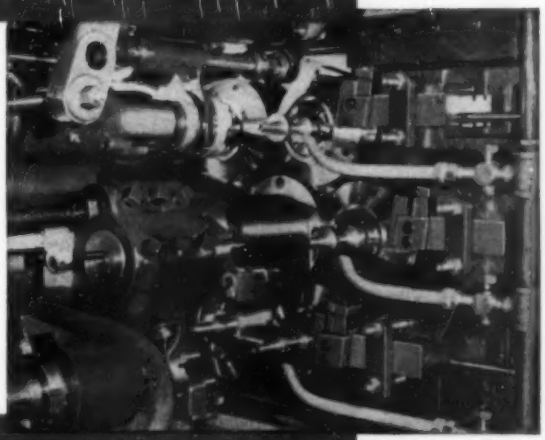
Front Side of Tooling Area 1-5/8-SIX

THE FACILITY BEHIND THE NEWS

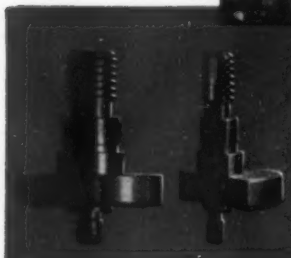
Case histories have appeal, whether they're about someone's time being bettered at a lathe or at an altar. Success likes success, and "misery likes company."

An "automatic's" case history is just an *end* of a *means* of machining facility. If you procure the right facilities, good case histories will result in *your* plant.

When selecting the best multi-spindle automatic facility for *your* needs, you will want to compare *all brands*. But you should have *full* information for a thorough comparison. You can have it on CONOMATICS.



Rear Side of Tooling Area 1-5/8-SIX



Cross drilling, cross milling, end broaching, end milling, and sawing operations are commonly performed by stopping the work spindles — often a costly procedure. For certain requirements, such as for the broached hole in the piece shown, CONOMATICS have performed all of the operations mentioned without stopping the work spindles.

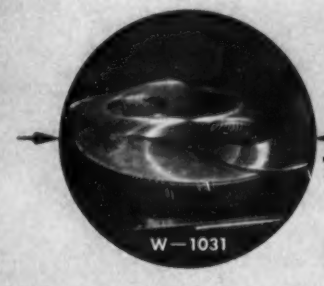
A Comparison of ALL Automatics is in favor of Cone

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

±.0025"

.4365"

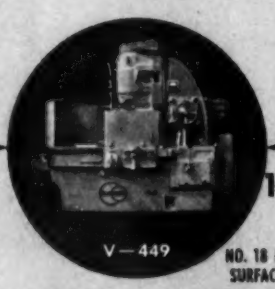
17½"



40"

HOW ELSE COULD YOU DO IT SO WELL . . . SO QUICKLY?

Many difficult flat surface machining jobs like this can be done best on a No. 18 Blanchard Grinder. This 3/4" x 24-1/4" x 40" hot rolled steel plate was ground on 2 sides (three operations) to a thickness dimension of .4365" ± .0025" and flat and parallel within .002". Each side was ground in two steps, because the plate overhung the 36" chuck, and the cuts were blended perfectly. 5/32" of stock was removed per side—a total of 57 lbs. of metal was removed in 2-1/2 hours!



NO. 18 BLANCHARD SURFACE GRINDER

24"

Send for your free copies of "Work Done on the Blanchard," fourth edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

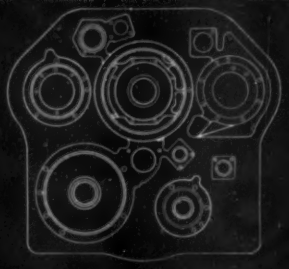
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

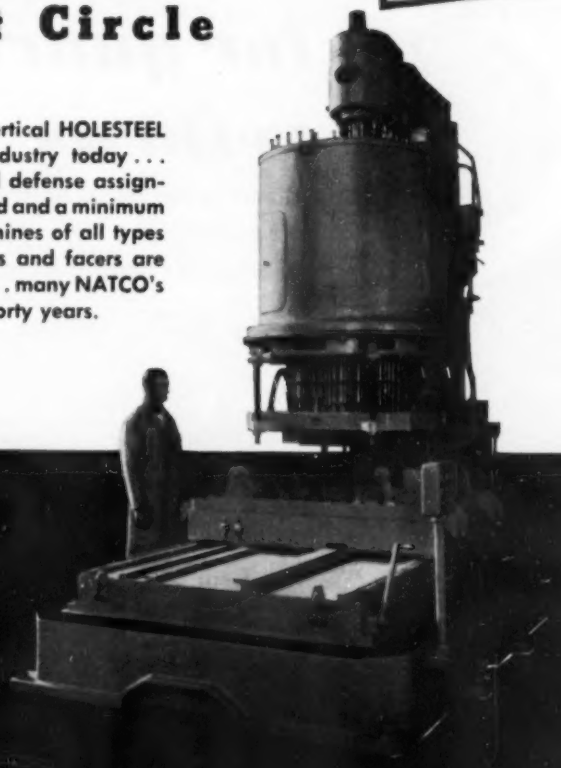
MAMMOTH NATCO

Drilling 50 Holes on 36" Bolt Circle

Natco Engineered for Quality Production

NATCO Model C4B Vertical HOLESTEEL drillers are at work for industry today . . . doing tough peacetime and defense assignments with a maximum speed and a minimum of down time. NATCO machines of all types . . . drillers, borers, tappers and facers are veterans of years of service . . . many NATCO's are now in operation over forty years.





Call a Natco Field Engineer

to help you solve your problems in Drilling, Tapping, Boring and Facing

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

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Invest in better methods for guaranteed returns
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THE NEW BRITAIN GRIDLEY MACHINE DIVISION
THE NEW BRITAIN MACHINE COMPANY
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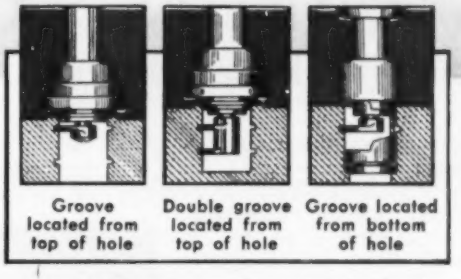
Waldes Truarc Internal Grooving Tool

for precision cutting of internal grooves in bores and housings

FAST! ECONOMICAL! NEEDS NO SKILLED LABOR!



Groove located from top of hole | Double groove located from top of hole | Groove located from bottom of hole

Internal groove-cutting becomes the simplest of operations with Waldes Truarc Internal Grooving Tool. Easy to adjust—easy to operate...readily adaptable to individual requirements.

Designed for use in any hand drill or automatic drill press and screw machine... assures a concentric recess without injury to metal. Operates by fingertip pressure—especially suitable for unskilled operators.

The Waldes Truarc Grooving Tool when used in an electric or pneumatic hand drill, can be taken to the job eliminating disassembly and excessive handling...resulting in all-around savings in time and costs!

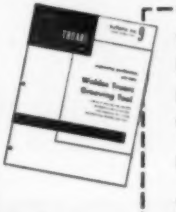
Write now for new 12-page Catalog giving mechanical details, cutting sizes...extra features...full information

WALDES

TRUARC

REG. U. S. PAT. OFF.

GROOVING TOOL



WALDES KOHINOOR, INC., 47-16 Austel Place, Long Island City 1, N.Y.
Waldes Truarc Grooving Tool
Manufactured under U. S. Pat. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Place Long Island City 1, New York AM-104

Please send me your new 12-page Catalog on Waldes Truarc Internal Grooving Tool.

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You can't lick this stamp!

. . . It was done on a KRW Hydraulic Press . . . famous for doing all kinds of stamping work faster, better, at less cost!

Sometimes minor production operations can become major headaches. Take the case of Buffalo Meter Co., makers of water, oil and specialty meters. Stamping the serial number on the lid of each meter was formerly done on a hand press and caused no end of trouble. Sometimes the number would not register exactly on the plate; sometimes the operator applied too much pressure and the lid was sprung. It was slow, tedious, inaccurate work, hard on the operator.

Buffalo Meter solved the problem with a 25 ton KRW Motor Driven Hydraulic Press. Now one man can stamp upwards of 300 meter lids per hour — more than four times as many as before. Each number is in perfect register. And there are no more sprung lids because each stroke of the KRW press produces exactly the same amount of pressure. It's a small job, but it illustrates the value of a KRW hydraulic press for any stamping job.

Any stamping or other pressing problems in your plant? Check with KRW. We have a full line—25 to 150 ton capacities; one, two and three cylinder models; hand operated, air operated or motor driven. If you need a *special* press, we'll build it for you.

Call your local Machinery dealer; or write, wire or phone Dep't. 11 for facts, prices and delivery dates.

SINCE 1916 KRW A MARK OF DEPENDABILITY

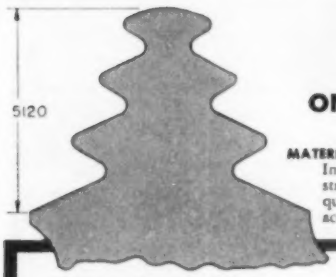
K·R·WILSON

215 MAIN STREET • BUFFALO 3, N. Y.

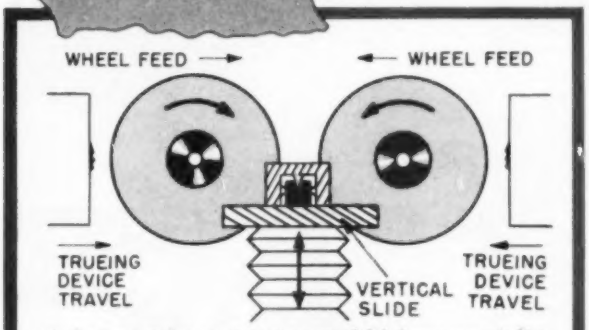
Designers and builders of Hydraulic Presses to meet any metal-working problem

FORM GRINDING
JET ENGINE BUCKET ROOTS
FROM THE SOLID!

ON J & L DUAL-WHEEL AUTOMATIC FORM GRINDERS



MATERIAL BORDERS ON UNMACHINABLE Intense heat and great centrifugal stresses on the pressure surfaces require the toughest material and most accurate finish.



Bucket is mounted on a reciprocating vertical slide for two-way grinding.

AUTOMATICITY SPEEDS PRODUCTION — MAINTAINS REPETITIVE ACCURACY — Operation is simplified to the push button stage by a completely automatic work cycle.

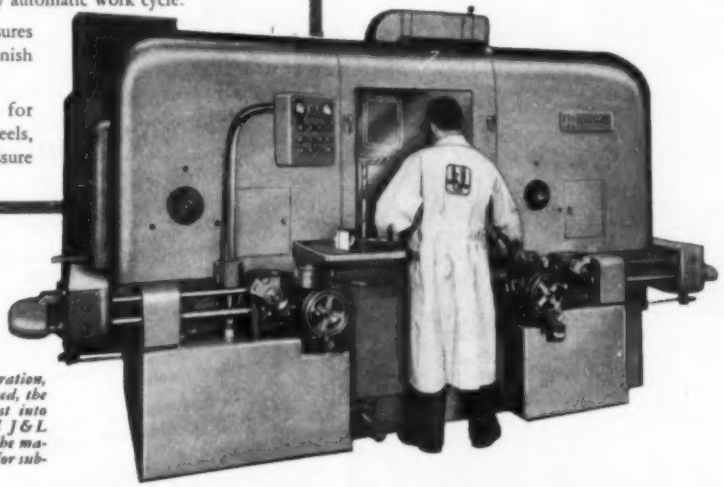
Automatic wheel trueing assures accuracy of form — includes finish trueing before final cut.

Automatic compensation for amount dressed off the wheels, and automatic wheel feed assure accurate sizing.

FEW MORE DIFFICULT GRINDING JOBS EXIST — Yet both sides of the root are ground simultaneously, to gage tolerances, on a production basis.

REPETITIVE ACCURACY MAINTAINED
Spacing of pressure surfaces within .0002
Taper within .0005
Angles within 10 minutes
Thickness from .0005 to .001

ACHIEVEMENT RESULT OF SEVERAL YEARS' RESEARCH AND EXPERIMENTATION — This application of the proven principles, long incorporated in J & L Thread Grinders, was initiated several years ago. The first machine was delivered in 1948. Continued study and subsequent refinements have helped lick one of the toughest machining problems of our day. Perhaps we can help you too.



Before the grinding operation, the foil contour is checked, the blade oriented and cast into a matrix, on a special J & L Optical Comparator. The matrix serves as a fixture for subsequent operations.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., Springfield, Vt., U.S.A. Dept. 710 — **THREAD GRINDER DIVISION**

coolants and lubricants for MACHINING
drawing lubricants for FORMING
compounds for metal CLEANING
core oils for CASTING
salts and quenching oils for HEAT TREATING
inhibited coatings for RUST PREVENTION

LET HOUGHTON HELP YOU GET MORE

NEW HOUGHTON PROCESSING AIDS

- ☐ Want a single water soluble cutting base that will handle 90% of all machining jobs?
- ☐ Or, an additive for water used in grinding, that will inhibit against rust?
- ☐ Or, a rust preventive film so thin you can't see it, yet protective for such long periods?
- ☐ Or, a quenching oil faster in quenching speed than any oil medium yet developed for lean alloy steels?
- ☐ Or, a phosphate cleaner that cleans and protects . . . aids paint adherence?

Check any item on which you want full data, sign in the margin of this page, and mail to E. F. HOUGHTON & COMPANY, 303 W. Lehigh Ave., Philadelphia 33, Pa.

Houghton on-the-job service brings you results

No one knows your production problems as intimately as you do. But Houghton on-the-job Service can often add something to your experience that will result in a quicker and more satisfactory answer. This on-the-job Service is rendered right out in your shop by your Houghton Man. He is constantly meeting up with a wide variety of problems as he is called into metalworking plants. You not only get the benefit of his extensive experience in getting to the crux of the problem, but back of him is the Houghton organization with 80 years of research and development work. If he doesn't know the answer—he'll get it from our technical staff. Have your Houghton Man take a look at your metalworking operations. A lot of plant managers are finding that this simple step brings surprising results.

OUT OF YOUR PRODUCTIVE CAPACITY

You'll get more efficient operation the Houghton way

Houghton is not just a line of products. Over the years, Houghton research has constantly been finding new ways to improve processing in metalworking plants. It is these new ways and new methods that you benefit from, along with many specially formulated products, when you work with Houghton. Many a plant like yours is finding it possible to relieve production bottlenecks—and bring down costs—with the aid of Houghton "job tailored" products and experience.

Helpful data makes Houghton products easier to use

Three generations of Houghton men, plus an active and continuing program of product and application research, have given us a lot of useful data and information. Much of it has been put into printed form to make Houghton products easier to use. If your problem concerns metalworking operations, it's safe to say that we have produced data sheets, reports, booklets—even textbooks—that will help you. Ask the Houghton Man.

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Ready to give you on-the-job service . . .

WHAT *Life-Lines* REALLY DELIVER IS MORE SERVICE...LESS SERVICING

Only modern motors and controls give you these features

Motors and controls have been built much the same way for years. Motors required frequent lubrication . . . controls needed constant maintenance. But, you can get really modern equipment built to standards that match today's speeded production requirements.

"De-ion" arc quenching used on Life-Linestarters® has proved the most efficient method of increasing contact life and interrupting capacity. Pictured on the left is the exclusive Westinghouse "De-ion" Quencher at work. In 1/120 of a second, arcs are confined, divided, extinguished—a *basic* to long contact life and equipment protection. It's the last word in arc quenching. Combined with silver contacts, this "De-ion" principle eliminates the need for constant contact maintenance. Contacts *never need* filing.

Pre-lubricated bearings on Life-Line motors have introduced new freedom from motor maintenance. You can throw your grease guns away. You eliminate bearing failures due to overlubrication, under lubrication, and from entrance of dirt into bearings. Result is reduction of motor down time. Certainly, the way to grease a modern motor is *don't*. Results of over half a million Life-Line motors serving every phase of industry show motor failures cut in half!

It's this kind of advanced features that puts Life-Line motors and Life-Linestarters years ahead of conventional equipment. Get all the reasons why. Ask your Westinghouse representative for full details, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21693

Life-Line
MOTORS and CONTROLS

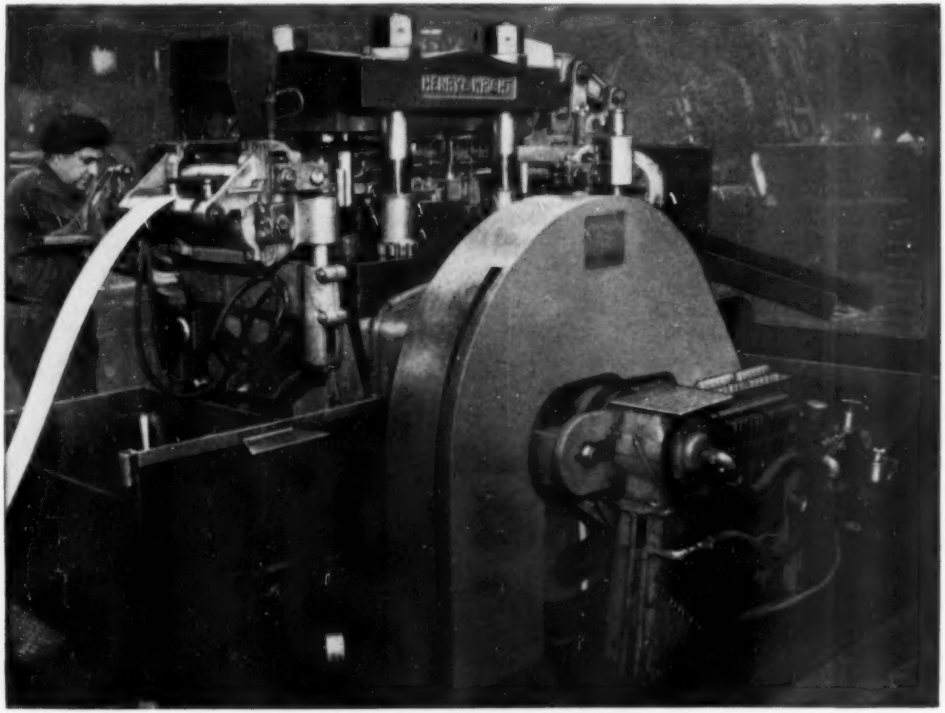
It Pays Three Ways To

First, you can combine operations — use progressive dies for metal stamping jobs that normally would require several presses. Second, you get high speed at no sacrifice in quality of work. Third, you get longer die life.

These benefits are inherent in the design of the Henry & Wright Dieing Machine. It is built to give them. Note low center of gravity — flywheel, crankshaft, connection are below the punchholder. This permits high speed, but minimizes vibration.

Maximum guiding surface is provided in the four-post punchholder guide, assuring constantly accurate alignment. A pulling stroke is applied to the die and the punchholder takes only the load required to do the work in the die. Any angular thrust from the crankshaft is absorbed by the lower crosshead.

For more pieces per minute and between grinds — for less handling and more finished work — modernize with Henry & Wright Dieing Machines. They are precision-built to do precise work.



In Chrysler's Highland Park Plant, Henry & Wright Dieing Machines are used to make fluid coupling fins and torque converter impeller blades. Note the low center of gravity of the Henry & Wright Dieing Machine. It allows high speed with minimum vibration.

OTHER EMHART PRODUCTS INCLUDE:

PRECISION QUALITY STAMPING PRESSES

THE V & O PRESS CO.

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HUDSON, NEW YORK

GLASS MAKING MACHINES

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PLASTIC BOTTLES, RODS, TUBES, SPECIAL SHAPES

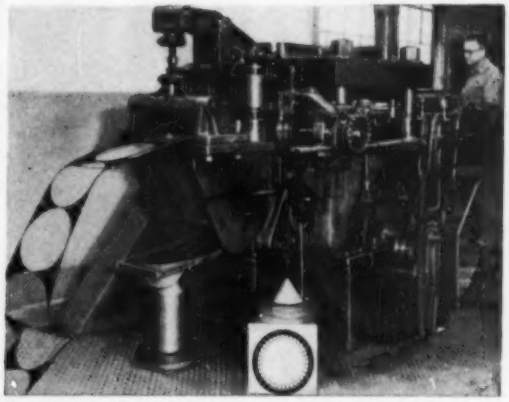
PLAX CORPORATION

Subsidiary of Emhart Mfg. Co.

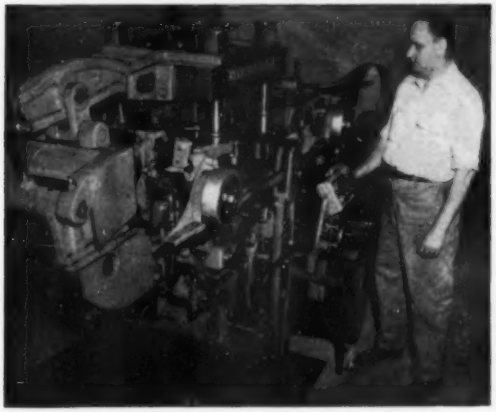
HARTFORD 1, CONNECTICUT

Modernize Metal Stamping-
with Henry & Wright Dieing Machines

Knapp-Monarch Produces completed rotor and stator laminations for its electric motors on 25-ton and 50-ton Henry & Wright Dieing Machines. Both pieces are made at once, at speeds substantially in excess of equipment previously used.



Rotor and Stator Laminations are made simultaneously of silicon steel on 150-ton Henry & Wright Dieing Machines at Fairbanks, Morse & Co. Unique feature of H & W design is that the upper crosshead takes only the pressure required to do the work in the die.



Numerous Types of motor laminations are made on the Henry & Wright Dieing Machines operating at General Industries. This illustration shows another unique advantage of these machines — the four post guide to the upper crosshead, which assures accurate and constant alignment.

Only the best is good enough

FACT PACKED CATALOG

Complete descriptions of all Henry & Wright Dieing Machines. Write: Henry & Wright, 421 Windsor St., Hartford 5, Conn.

H&W

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Division of Emhart Mfg. Co.

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DODGE-TIMKEN PILLOW BLOCKS

Rugged!

Compact!

HERE are the bearings for industry's toughest jobs—in the most compact and rugged "package."

High radial and thrust capacities. Stamina to take heavy shock loads. All-steel construction that packs this load-carrying capacity into less weight and less space than ever before.

This brilliant achievement has been accomplished through pooling the engineering resources and bearing-building experience of Dodge and Timken. This new line so completely fills a need that engineers are already specifying "Dodge-Timken All-Steel" for some of America's heaviest machinery and largest industrial projects.

Completely assembled, permanently adjusted, lubricated and sealed at the factory, these All-Steel pillow blocks are shipped ready to go to work—wherever in industry the going is tough!

For detailed information and delivery dates write to Dodge, or call your Dodge Distributor.

DODGE

Mishawaka, Ind.

CALL THE TRANSMISSIONEER your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

A JOINT ENGINEERING DEVELOPMENT BY DODGE AND THE TIMKEN ROLLER BEARING COMPANY

SHAFT SIZES: $2^{15}/_{16}$ to 10 in.

- All-Steel construction
- A new Timken bearing design
- High radial and thrust capacities
- Compact—minimum dimensions
- Minimum weight; maximum strength
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- Sealed both on and off the shaft
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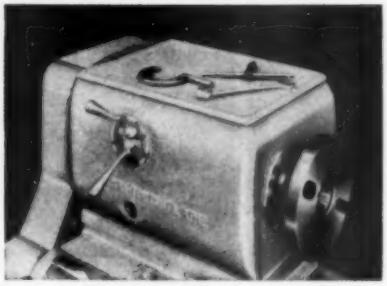
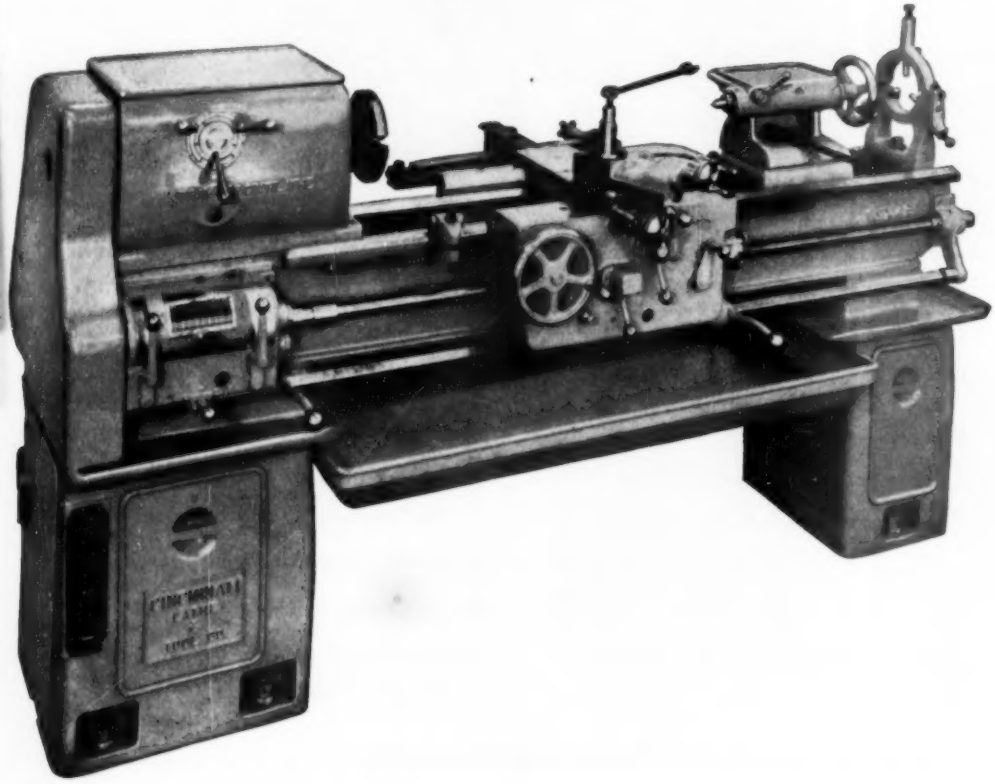
can you top this for convenience ▸

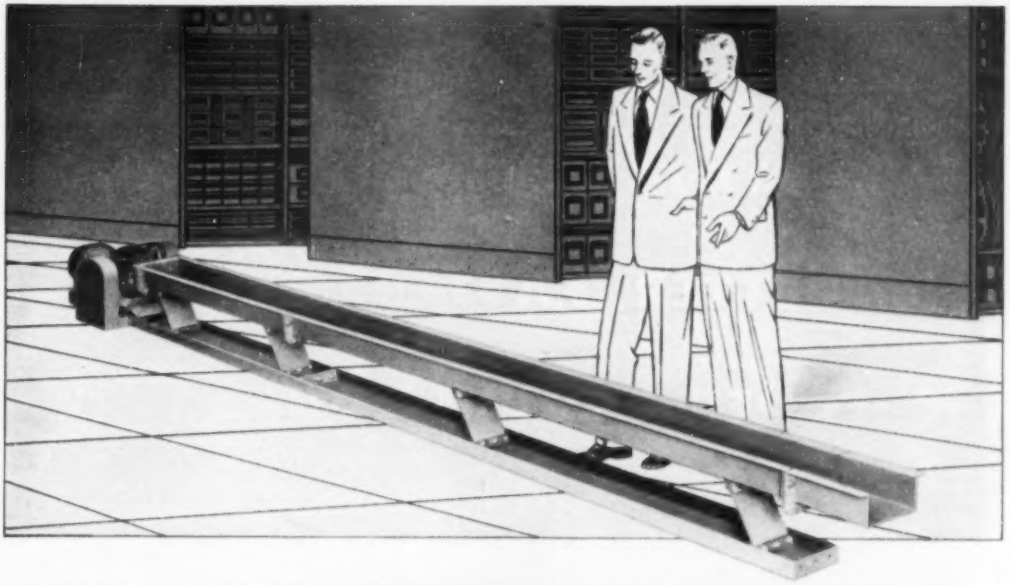


Tray-Top Cintilathes keep mikes, tools, drawings and accessories close at hand, save operator's time for productive use. Other features include all geared head, totally enclosed quick change gear box, 12 speeds, 48 thread and feed changes, start-stop control on apron, large spindle hole, flame hardened gears, ground bed ways, accessible externally mounted main drive motor and many others. Yet Tray-Tops are budget-priced. Swing sizes: 10″, 12½″, 15″ and 18″. Write for catalog and name of your nearest dealer.

CINTILATHE

CINCINNATI 9, OHIO, U.S.A. **cincinnati lathe & tool co.**





Now you can buy FLEXMOUNT Oscillating Conveyors "right off the shelf"

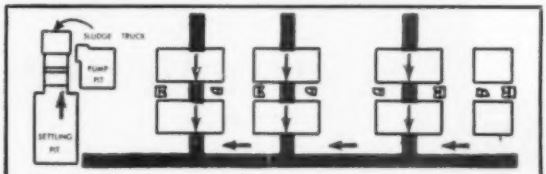
Stock sections make FLEXMOUNT Positive-Action Conveyors easy to order... easy to install

Yes, you can now get FLEXMOUNT Oscillating Conveyors for immediate delivery from stock. There's no more waiting for special engineering—stock sections are easily built up to any length desired.

This off-the-shelf service applies to 8, 12 and 18 in. trough widths. For greater capacities, Link-Belt has heavy-duty designs. All offer lower handling costs in carrying off and collecting chips, turnings, punchings, stampings, blasting shot.

Compact, leakproof design makes FLEXMOUNT ideal for moving coolant-soaked chips. Handles bolts, bars, broken tools, even rags without jamming. If desired, dividers can be installed to convey simultaneously two or more types of materials without mixing.

Versatile, low-cost FLEXMOUNT Conveyors are easily kept clean, can be made dust-tight if desired. For all the facts, write for your copy of new Book 2478.



To eliminate manual handling from chip-removal operations, new engine plant has made wide use of FLEXMOUNT. Conveyors beneath machines empty into main conveyor which carries chips and oil to collection point.

How Positive Action moves material...

Positive-action, constant-stroke eccentric drive provides a powerful, yet gentle upward and forward oscillating motion. Large volumes of material are moved in a uniform, continuous flow, regardless of surges. Natural spring action of resilient legs reduces power requirements to a minimum.

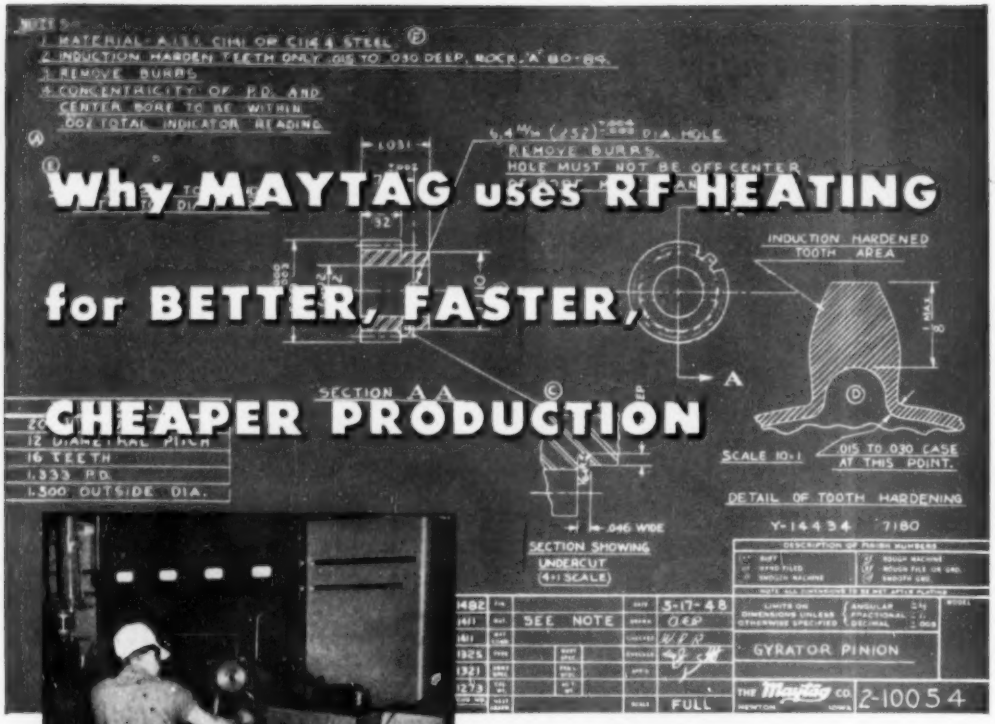
LINK-BELT

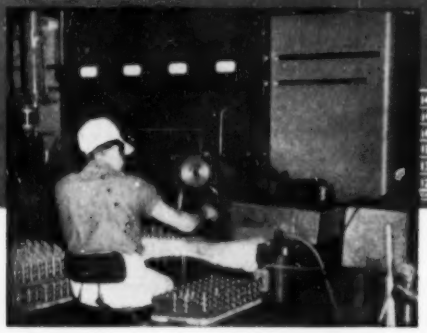
12,108-A

FLEXMOUNT OSCILLATING CONVEYORS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

Why MAYTAG uses RF HEATING for BETTER, FASTER, CHEAPER PRODUCTION


NOTES:
1. MATERIAL - A.I.S.I. C1141 OR C1144 STEEL
2. INDUCTION HARDEN TEETH ONLY .015 TO .030 DEEP, ROCK "A" 80-85.
3. REMOVE BURRS
4. CONCENTRICITY OF P.D. AND CENTER BORE TO BE WITHIN .002 TOTAL INDICATOR READING
SECTION A-A
INDUCTION HARDENED TOOTH AREA
SCALE 10:1
.015 TO .030 CASE AT THIS POINT.
DETAIL OF TOOTH HARDENING
SECTION SHOWING UNDERCUT (4:1 SCALE)
12 DIAMETRAL PITCH
16 TEETH
1.333 P.D.
1.500 OUTSIDE DIA.
SEE NOTE
5-17-48
GYRATOR PINION
FULL
2-10054



● The Maytag Company has found, for fast production at low cost and high quality, Westinghouse RF Heating installations are the answer.

The installation of a process using two 20 KW-450 generators—for both spline and straight shaft hardening—has paid for itself in *less than 3 months!* This was shortly after World War II, and since then continued use has piled up real profit in savings.

In building a new plant for production of a completely new line of automatic washing machines, Maytag turned to induction heating for brazing and hardening . . . and they specified Westinghouse. A 50 KW and 10 KW RF generator, with associated work handling equipment, are now accounting for still further savings and continued high quality. That's why Maytag says that not only is the Westinghouse RF process the best method for heat treating production parts, but, also, "it produces precision work at the price of rough and ready work."

As we helped Maytag, let us help you solve your problems of increased production at low cost and with high quality. By all means, investigate the possibilities of installing Westinghouse RF Heating.

J-03341

Westinghouse Electric Corporation
Department M-41
2519 Wilkens Avenue · Baltimore 3, Maryland

Send me your informative case history booklet on induction heating.

Name .....

Company .....

Street .....

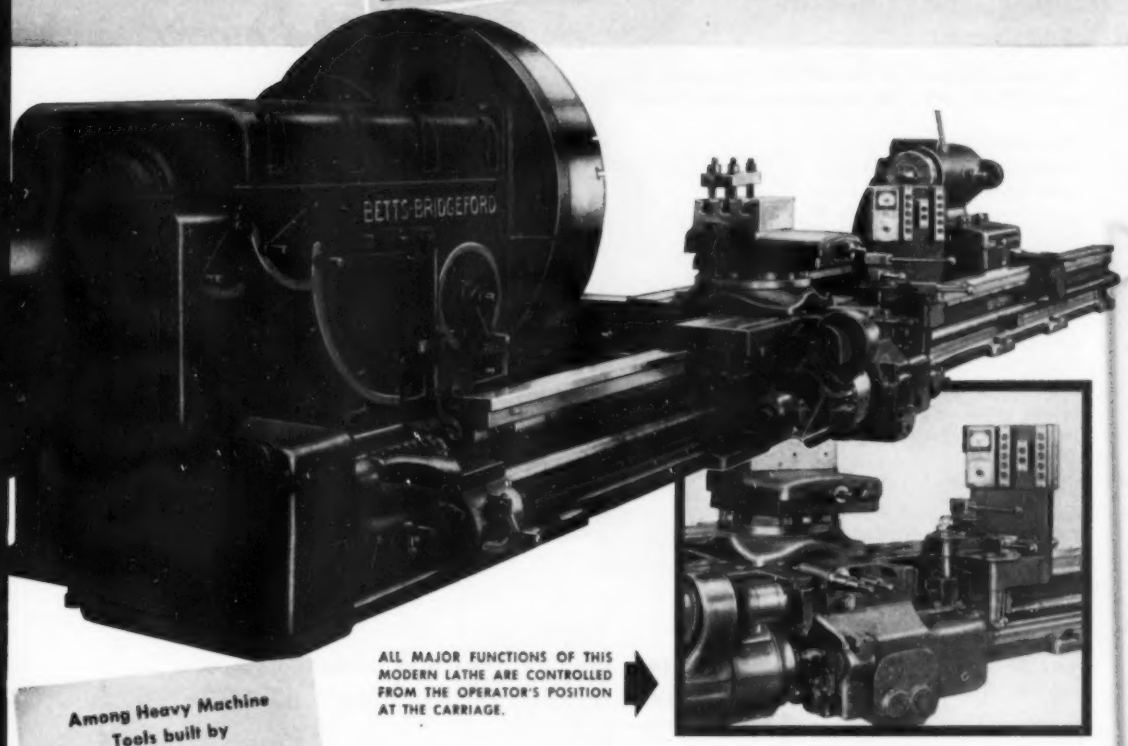
City ..... Zone ..... State .....

INDUCTION HEATING

BETTS-BRIDGEFORD

ELECTRONIC FEED

60" HEAVY DUTY LATHE



ALL MAJOR FUNCTIONS OF THIS MODERN LATHE ARE CONTROLLED FROM THE OPERATOR'S POSITION AT THE CARRIAGE.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

- Wide speed range permits use of either high speed steel or carbide tools.
- Feed and traverse functions entirely independent of thread cutting mechanism.
- Feed rate and cutting speed, within the range of their respective motors, are adjustable independently without interrupting the cut.
- Lead screw for thread cutting only.
- All anti-friction bearing headstock.
- Hardened steel bedways.
- Main drive motor speeds and feed and traverse functions are conveniently controlled from the operator's position at the carriage.

- Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

Lodge & Shipley 60" T* lathes

in 6 distinctive models

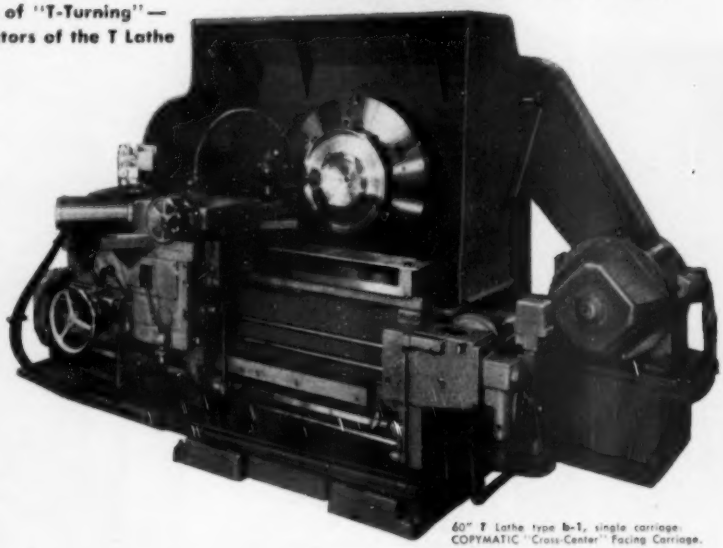
Further advances in the art of "T-Turning"— brought to you by the originators of the T Lathe

Developed as a result of the experiences and needs of jet engine manufacturers and others, these latest type Lodge & Shipley ***T*** Lathes offer even greater speed, accuracy and ease of machining.

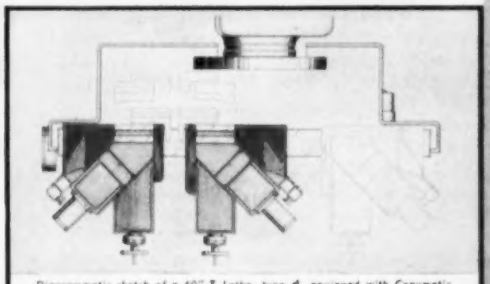
These lathes have one or two carriages, either or both of which may be COPYMATIC controlled for automatic contour turning, facing and boring of short, thin-walled section work of large diameter. The new carriage arrangements further advance the art of *"T-Turning."*

Basically, the ***T*** Lathe costs less than conventional machines, saves 50% or more in floor space, obsoletes the use of large cumbersome engine and raised lathes for this type of work.

Write for complete information and new ***T*** *Lathe literature.*



60" T Lathe type b-1, single carriage; COPYMATIC "Cross-Center" Facing Carriage.



Diagrammatic sketch of a 60" T Lathe, type d, equipped with Copymatic Tracer Control for turning and boring with dual carriages.

Choose a Lodge & Shipley *T* Lathe designed for short, thin wall large diameter work

Type a-1	for straight and angular facing, turning, boring
Type b-1	for contour facing on both sides of center . . . limited contour turning and boring
Type d	for contour turning, boring; straight facing and limited contour facing
Type e	for contour turning; straight and angular facing, turning, boring
Type i	for straight and angular facing, turning, boring
Type n	for straight and angular facing, turning, boring and contour boring

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

*T. M. The Lodge & Shipley Co.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol Cutting Oil 20-TA

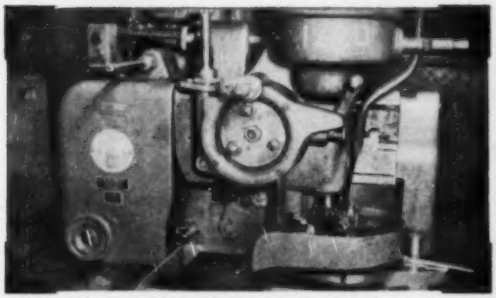
TOOL High-speed gear shaper + others

LUBRICATOR Circulating and hand

SERVICE Making fuel-burner and engine parts

FIRM Iron Fireman Mfg. Co. Portland, Oregon

Calol cutting oil triples machine-tool life!



THIS HIGH-SPEED GEAR SHAPER, in the big Iron Fireman Manufacturing Co. shop at Portland, Oregon, required a new cutting tool every half day until Calol Cutting Oil 20-TA replaced the comparable type competitive lubricant being used. Now tools on the machine are only changed after 1½ days of use. "Besides three times longer tool life, I get good surface finish at high speeds with Calol Cutting Oil, and it costs me far less than the oil I was using," says Bill Huntley, Maintenance Foreman.

CALOL CUTTING OILS are used in all the many machining operations in Iron Fireman's shop. This includes thread grinding (shown here), shaping, hobbing, drilling, turning and broaching. There is a complete line of Calol Cutting and Soluble Oils to meet every machining condition. They come in four general types: Mineral oils, ready-mixed compounded oils, concentrates and soluble oils.

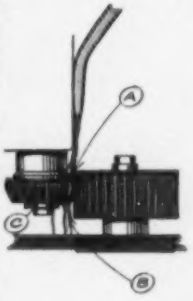
How to increase efficiency in all metal-cutting operations

Use the correct Calol Cutting Fluid for any operation from grinding to broaching. Recommendations for each are made from actual working results.

A. Have high cooling and lubricating qualities—minimize "built-up edge" and promote good finish.

B. Flush away cuttings readily.

C. Protect machine and work against rusting and corrosion.



FREE CATALOG: "How to Save Money on Marine Equipment Operation," a new booklet full of valuable information, is ready for you. Write or ask for your free copy today.

CALOL

TRADEMARK "CALOL" REG. U.S. PAT. OFF

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

however
wherever
whenever
YOU HAVE A
SHIM PROBLEM
Get the right,
economical answer
from
LAMINATED
SHIM
COMPANY, INC.
"SHIM HEADQUARTERS" SINCE 1913
Shim design is modern design. It saves precious, extra, needed hours of machining parts to needlessly close tolerances.
Today the pressure is on speed. Production lines must move fast. Machine time has to be reduced. Two seconds with a shim can save two hours with a machine. Without sacrifice of quality in your end product.
So — when you face a shim situation, it will pay you to check with "Shim Headquarters." Don't just buy a stamping when you need a shim. Our engineering service can be important to you.
ONLY LAMINATED SHIM OFFERS YOU ALL 5

ONLY LAMINATED SHIM OFFERS YOU ALL 5 SOLUTIONS

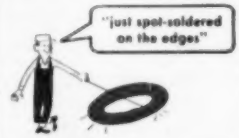
Here's a quick picture of the shimming methods which are at the disposal of designer and production engineer. In actual use, many factors affect choice of proper type, for shim engineering has become a science unto itself. Be sure you check with us for an impartial recommendation. Remember that only The Laminated Shim Company offers you all 5 types of shims.

THE LAMINUM® SHIM

SIMPLY PEELS FOR ADJUSTMENT

The LAMINUM® Shim is made up of layers of .002 or .003 inch brass or steel, metallically bonded together over their entire surfaces. Peeling laminations with a penknife gives simple, accurate adjustment; no counting or miking is necessary. Shim is rigid, easy to handle, less compressible than solid metal. No grit can lodge between layers. Available in from 3 to 63 laminations.

THE LAMISOL* SHIM



FOR QUICK, ASSEMBLY LINE USE

The laminations of the LAMISOL Shim (in brass only) are joined by spot-soldering. This type of shim is just right for high speed, repetitive assemblies, regardless of the shim size involved. Spot-soldering makes a very firm "pack," but the laminations are quickly removed. Laminations within the same shim do not need to be all the same gauge, nor is the maximum number of layers limited.

THE LAMITAB* SHIM

FOR SUPER SPEED, THIN GAUGE SITUATIONS

The LAMITAB Shim is a patented exclusive developed by us for the extremely fast moving production line. The little tab holds the shims together firmly, yet is easily removed. Different metals can be used in the same shim. The LAMITAB Shim is unsurpassed, cost-wise and time-wise when properly engineered. Maximum number of laminations is 4, to a total thickness of .010 inch.

THE LOOSE LEAF SHIM

FOR UNLIMITED FLEXIBILITY

The loose leaf shim is the simplest of all custom-stamped shims. It is completely flexible. There is no limit on number or gauge of each shim — and an occasional situation will require this "wide open" adjustment. In such cases, sets incorporating a variety of gauges are made up. Then, by removing one gauge and inserting another, a full scale of fine gauge adjustment is made possible.

PACKAGED SHIM STOCK

READY FOR EASY USE, WITHOUT WASTE

Our Packaged Shim Stock is available for maintenance work from your Industrial Distributor. 6" x 100" roll feeds through package slots, *as it's used*. Available in 11 gauges, from .001 to .010", brass and steel. Heavier gauges to .032 are packed flat, two 6 x 25" sheets to an envelope. Laminated shim stock for maintenance use is also available in a variety of thicknesses and lamination arrangements.

*T.M. Applied For

ONLY LAMINATED SHIM OFFERS YOU ALL 5

LINDBERG at the

see our new LINDBERG CARBONITRIDING FURNACE

Here's the greatest advance in industrial furnace design and construction since Lindberg introduced the Lectrodraw conveyor furnace back in 1938!

Change tubes like the Model in your shop? It's easy to change the new sidewall tubes...all in one unit and hang new ones in place... all in a matter of minutes.

Be sure to visit the Lindberg exhibit at the Metal Show,

Convention Hall, Philadelphia, October 20-24, 1952

Yes, you must see the new Lindberg Carbonitriding Furnace. It's many furnaces in one . . . it's easy to maintain . . . it's a self-contained unit.

Check these important construction features . . . features that will improve production quality and volume, and reduce production costs.

Many furnaces in one . . . Furnace atmosphere is provided by the Lindberg "Hyen" endothermic atmosphere generator that is easily adjustable to supply different atmospheres not only for carbonitriding, but also for carburizing, carbon restoration, bright hardening or annealing and normalizing. For annealing and normalizing the heated charge cools in the same chamber used for purging.

Easy to maintain . . . Instead of old style, heavy, unwieldly, horizontal radiant tubes . . . new gas-fired, lightweight tubes (only 29 pounds) are used. They're simple to change . . . turn off the gas . . . get on top the furnace . . . lift out the old tube . . . hang a new one in its place . . . and the thin, rolled metal tubes actually last longer!

Quench tank pit unnecessary . . . Your Lindberg Carbonitriding Furnace is self-contained, including a built-in pitless quench tank . . . thus you avoid costly excavation and piping. But more important, this built-in quench tank minimizes distortion . . . quenching takes place within the furnace structure, by means of a vertically operated elevator. Heated charges are never exposed to the air . . . as is the case when work is transferred from the heating chamber to a separate quench tank. Uniform case depth is assured because each charge automatically remains at heat the same length of time.

Purge chamber . . . A specially designed chamber, built immediately above the quench tank and in front of the heating chamber, receives work load for purging prior to heating.

For full details ask for Bulletin 241

LINDBERG FURNACES

ARMSTRONG

Modern Tooling Calls for *the Correct*

ARMSTRONG TOOL HOLDERS for each operation

In the old days it was a matter of pride with toolmakers to be able to do the work at hand with the tools at hand. It's a credit to their skill that they could devise to cut threads, do cutting-off and facing, as well as many other operations with one ARMSTRONG TURNING TOOL, but, at today's labor cost, this would be an expensive practice. The maximum of productive work and true machining efficiency can only be obtained by providing the correct ARMSTRONG TOOL HOLDERS for each operation.

The Armstrong System of Tool Holders provides specially designed ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters, and shapers . . . Turning Tools, Boring Tools, Threading Tools, Knurling Tools, Cutting-Off Tools; tool holders with straight shanks, with off-set shanks, rigid tools and "spring" tools . . . special tool holders for high speed steel bits or blades, for ARMIDE (carbide-tipped) Cutters, for ARMALOY (cast alloy) Bits and Blades.

These modern efficient ARMSTRONG TOOL HOLDERS are as available as your telephone for they are carried in stock by your local ARMSTRONG Distributor.

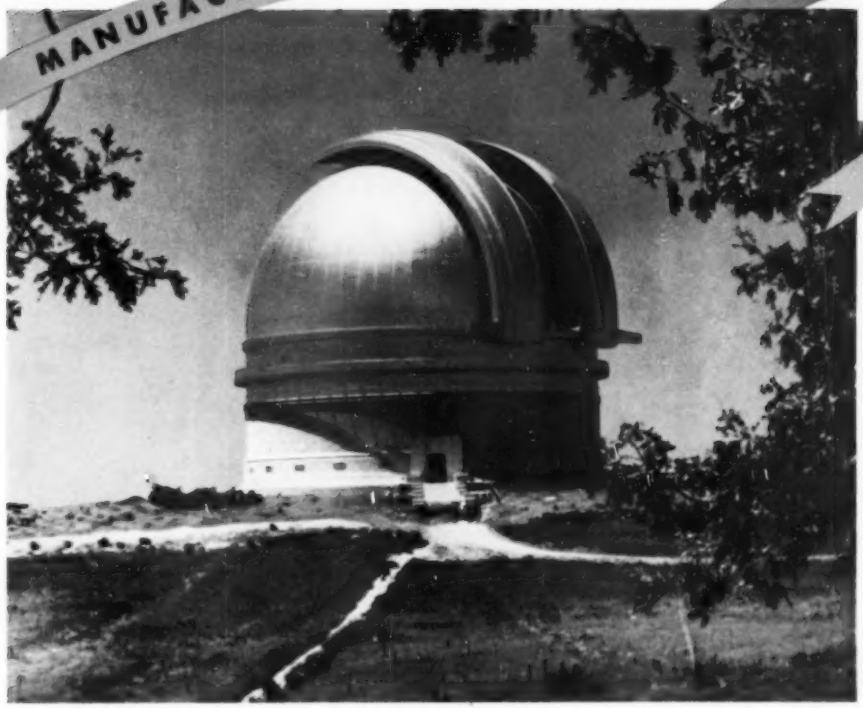
ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

BULLARD

MANUFACTURERS OF MACHINE TOOLS



Mount Palomar Observatory — 69 miles north of San Diego, California

Kaufman & Fabry Photo

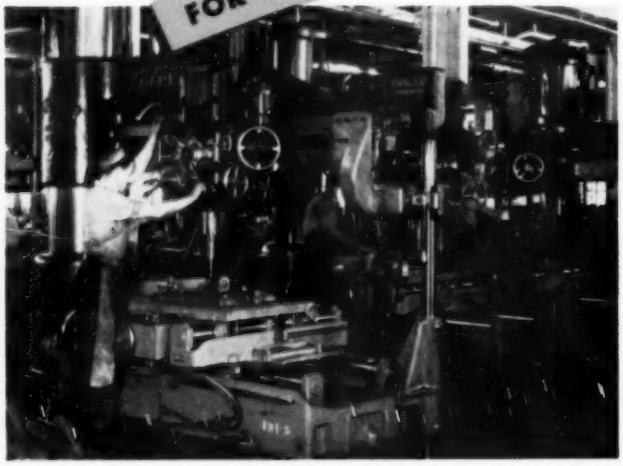
The Invisible Background of Industrial Progress

Among the many advancements in our country of free enterprise are the products of scientific research. Representative of such work is Mount Palomar Observatory of the California Institute of Technology. Located 69 miles north of San Diego, California, its 200-inch lens, ground at the University, brings the moon to within 28 miles of the earth. Palomar's big telescope used for photographing celestial objects can reach out to explore a spherical section of the Universe so colossal that light traveling 186,000 miles a second takes 2 billion years to cross the section. Such scientific equipment will permit more complete studies of the Universe and the effects of outlying bodies on our own world . . . In The Invisible Background of Industrial Progress are the manufacturers who use ★ *Modern Machine Tools* that enter into the many steps in the making of glass, grinding of lenses, producing delicate machinery and hundreds of other items required in the innumerable phases of scientific research.

★ *For greater manufacturing economy*
REFER to next page

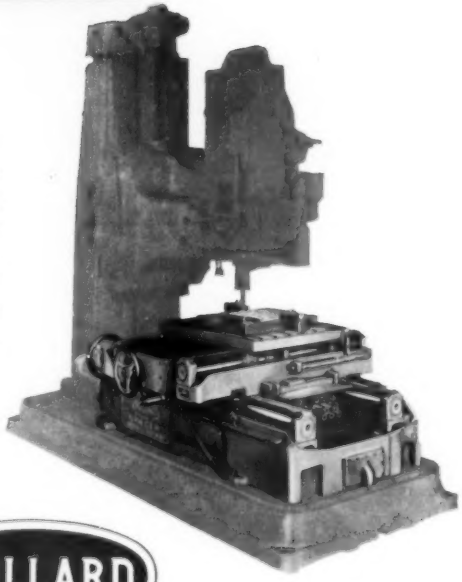
THE
BULLARD COMPANY
BRIDGEPORT 2
CONNECTICUT

BULLARD MACHINE TOOLS
FOR GREATER MANUFACTURING ECONOMY



The Bullard Spacer is an ingenious table-like machine designed to be mounted under the arm of an accurate radial drill or the fixed arm of the Cincinnati Super Service Precision drill. When so installed it provides an accurate means of spacing for drilling, boring, reaming and threading several pieces or longer runs of work without the costly medium of jigs.

In actual use, several hundred of these Spacers have not only proved their reproductive accuracy but have shown almost unbelievable savings in manufacturing costs. In many instances it has proved profitable to discard numerous jigs. In others where new products are in the design stage, the spacer operations were laid out and work was quickly put into production, without the usual delay required in jig design and jig fabrication.

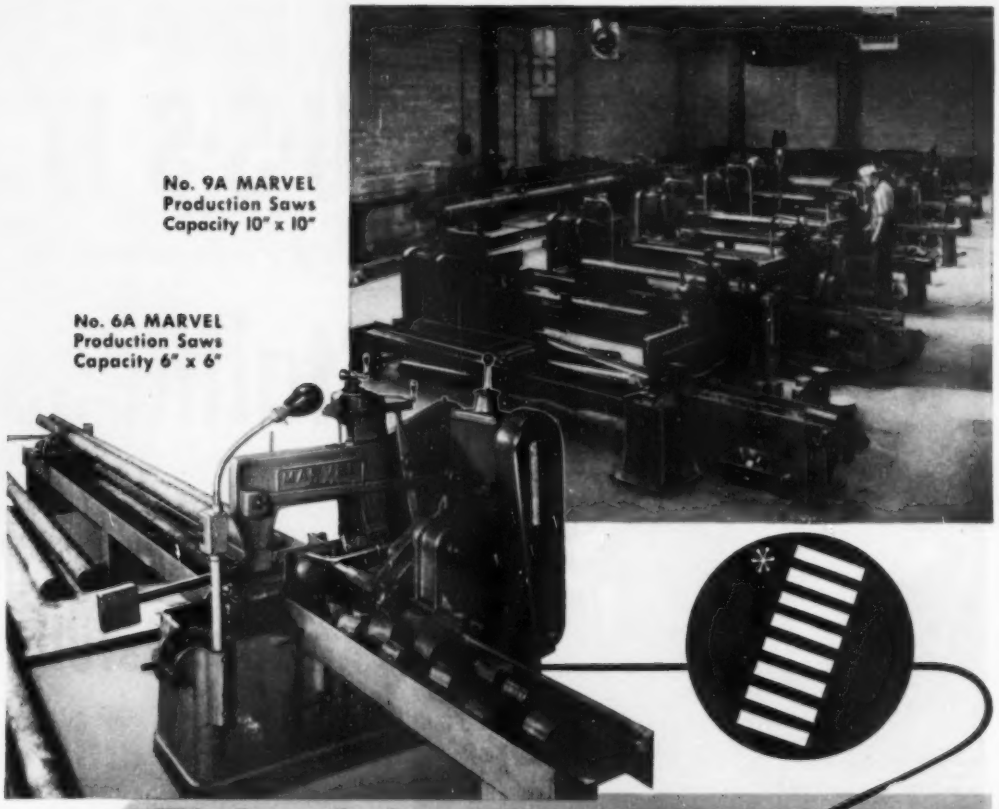


Bullard Spacer with a 32" x 40" table has 30" longitudinal and 20" transverse travels providing for a maximum of 260 hole locations in a single setting of the stops. Write for complete specifications.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



No. 9A MARVEL
Production Saws
Capacity 10" x 10"

No. 6A MARVEL
Production Saws
Capacity 6" x 6"

Eight of these MARVEL 9A Saws have already earned *Service Stripes**

Eight of these high speed MARVEL Production Sawing Machines at the Accuracy Steel Cutting Company, Hazel Park, Michigan, (a suburb of Detroit) operated almost continuously thruout the last war—cut up thousands of 20 ft. bars into accurate slices, pieces and lengths, for war production.

Now with a battery of fifteen of these world's fastest hack saws, Accuracy Steel Cutting Company has immense capacity to put behind defense and civilian work.

MARVEL Production Saws will automatically cut bar stock to size at terrific speed . . . they will feed, measure and accurately cut-off identical pieces from single or nested bars *automatically*, with no more operator attention than a battery of automatic screw machines.

Versatile, as well as accurate and fast, these saws can be stopped at any point in a production run—a miscellaneous cut made—and production resumed by simply re-engaging the automatic bar push up.

Write for Catalog

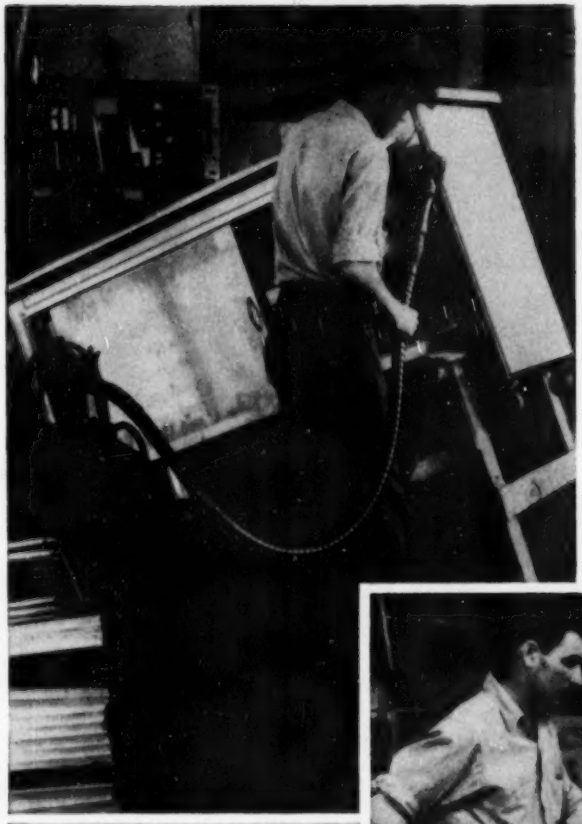
MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MANUFACTURING CO.

5700 Bloomingdale Avenue "The Hack Saw People" **Chicago 39, U. S. A.**

Straight-chromium U·S·S 17 [TYPE 430] Stainless Steel successfully



▲ **COOK'S TABLE** manufactured by Duke Manufacturing Company receiving final polish. The body of the table is 20 gage Type 430 Stainless Steel, the shelves are 18 gage and the top is 14 gage.

▶ **BODY ASSEMBLY** of the Thermaduke food warmer includes spot welding of the 20 gage Type 430 Stainless Steel.

VICE PRESIDENT J. M. Johnson of Duke Manufacturing Company (right) points out the features of a finished Thurmaduke food warmer made entirely of Type 430 Stainless Steel.

replaced nickel-bearing grade in this food serving equipment

RESTRICTIONS on nickel-bearing grades of Stainless Steel have focused the attention of fabricators on Stainless grades that are in good supply today—straight-chromium grades such as U·S·S 17 (Type 430) Stainless Steel. And fabricators who have switched to these available grades report their performance in both fabrication and end use is highly satisfactory.

Duke Manufacturing Company, St. Louis, Mo.—manufacturer of food serving equipment—has been using Type 430 as an alternate material for many months now. In every case, the same gage used in nickel-bearing grades was used in Type 430.

On the basis of this experience, Vice President J. M. Johnson reports:

"We find that Type 430 Stainless Steel is entirely satisfactory in appearance, durability and ease of maintenance for our Thurmaduke food warmers and cafeteria counters. In most cases, we have followed virtually the same fabricating techniques used with nickel-bearing grades."

The minor adjustments which Duke Manufacturing Company made in its fabricating methods included increasing the radius on certain corners and the grinding of sharp corners. Steps used in fabrication include shearing, notching, forming, spot, arc and heliarc welding, grinding and polishing.

U·S·S 17 Stainless Steel has proved to be the answer to supply problems for many manufacturers who formerly concentrated their attention on nickel-bearing grades of Stainless Steel. In switching to this straight-chromium grade, they have received valuable assistance from United States Steel Company representatives.

If you are interested in U·S·S 17 Stainless Steel, get in touch with our nearest sales office for complete information on its physical qualities and fabricating performance.

UNITED STATES STEEL COMPANY, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

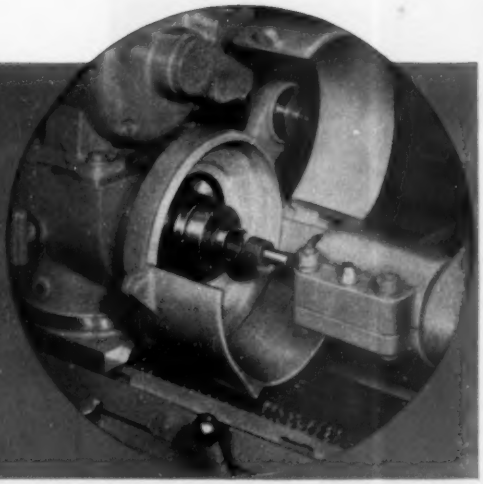
U·S·S STAINLESS STEEL

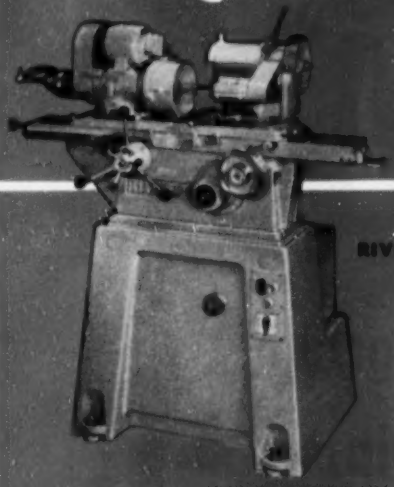
USS

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

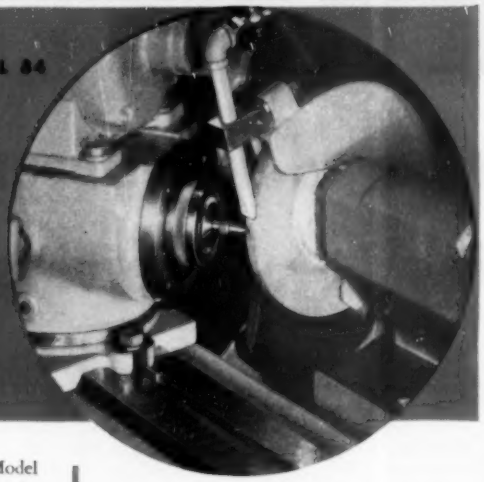
UNITED STATES STEEL

A new small hole grinder





RIVETT MODEL 84



Easily converted for external grinding

Flexibility keynotes this new Rivett Model 84. Primarily a small hole grinder, it may be equipped for external grinding. Simplicity reduces set-up time on the variety of work normal to the tool-room and die shop. Collets and step chucks quickly mount single or repetitive pieces.

The new Rivett 84 grinds holes from the smallest up to 3" diameter, with a maximum 4" depth depending upon diameter; external work to 3" diameter by 4" length.

If you need versatility with extreme accuracy, you will want to learn more about this new grinder. Send for Catalog 84.

FEATURES

- ★ Optional Wheelheads for internal and external spindles.
- ★ Internal Spindles 12,000 to 35,000 r.p.m.; sealed from grit and pre-lubricated for life.
- ★ Lathe-Type Workhead Spindle mounts draw-in collets and step chucks directly.
- ★ Micrometer Table Stop for positioning work when shoulder grinding.
- ★ Mechanical Power Table Travel with infinite adjustment of speed and stroke.
- ★ Hand Table Travel with coarse and fine feeds graduated to .001".
- ★ Hand Infeed with coarse adjustment to .001", and fine to .0001" reduction of work diameter.

RIVETT **LATHE & GRINDER, Inc.**

Dept. AMR-10, Brighton 35, Boston, Massachusetts

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

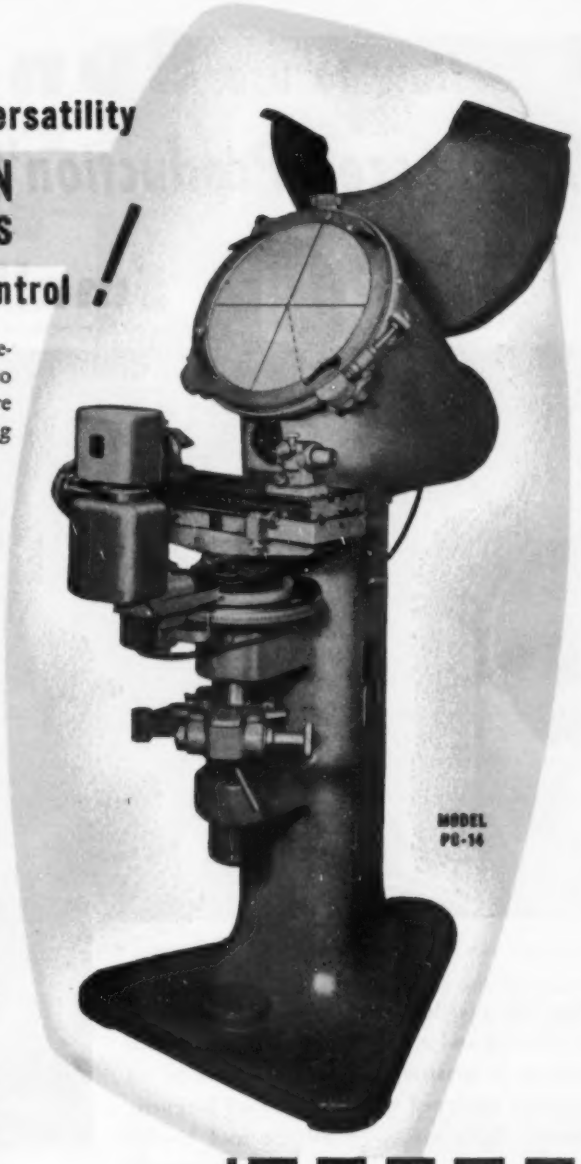
Unsurpassed Inspection Versatility

JONES & LAMSON
OPTICAL COMPARATORS

The Essence of Quality Control !

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- They meet the requirements of toolroom, laboratory and production inspection.
- They precisely measure height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- They compare intricately contoured parts with a master outline — and measure the amount of error.
- They are convenient to operate, easy to set up and read direct — *without computation.*
- They operate under normal lighting conditions. *No darkroom is needed.*
- They will photograph the enlarged shadow and record its relationship to a master chart.
- Several persons may study the shadow *at the same time.*
- They will inspect and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.



P.S. → Jones & Lamson Comparators guarantee swift, sure QUALITY CONTROL *throughout your production lines.* Write Dept. 710 for Catalog No. 402. One of our ELEVEN models will fit your needs.

Jones & Lamson Machine Company
Springfield, Vt., U.S.A., Dept. 710
Please send Comparator Catalog No. 402.

NAME _____ TITLE _____

COMPANY _____

STREET _____

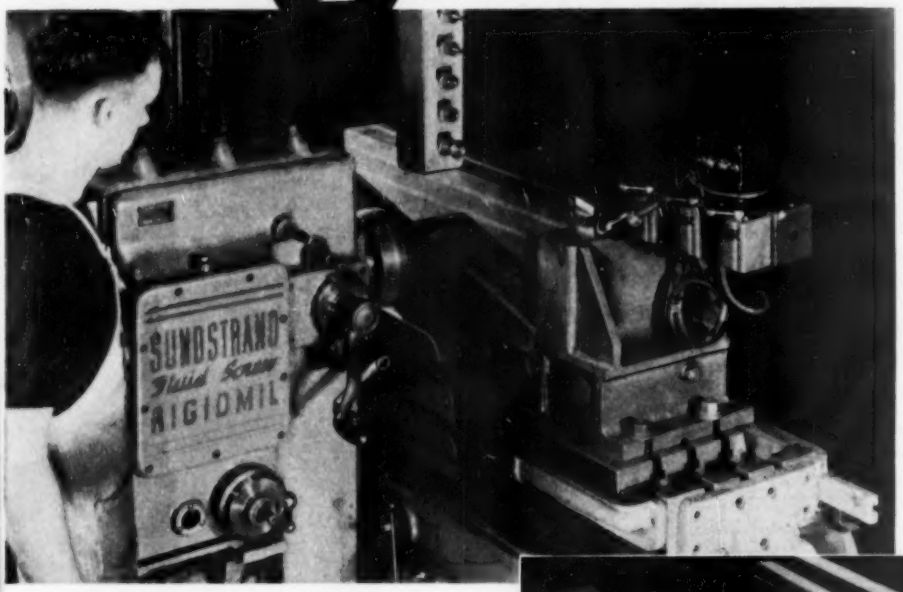
CITY _____ STATE _____

JONES & LAMSON
JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

J&L

Machine Tool Craftsmen Since 1835
COMPARATOR DIV.
Dept. 710

How to use Sundstrand "Engineered Production" and Equipment for... 1 Small Lot Milling

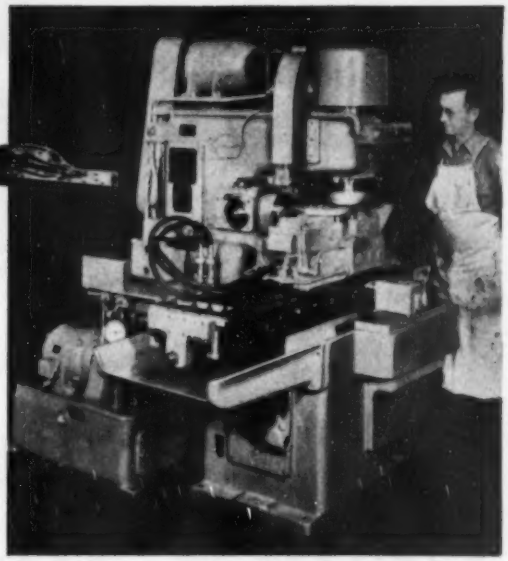


Here's an excellent combination for increasing production and cutting costs on miscellaneous milling. It consists of a Sundstrand Model 33 Rigidmil equipped with a Sundstrand Magnetic Fixture. Parts machined include tool blocks, cam bars, tool slides, motor brackets, etc. Lot sizes vary from 1 to 25 pieces, and time reduction averages 50% over former method. In addition to saving time through the elimination of mechanical clamps, these magnetic fixtures save the costs of special jigs or fixtures. Install a combination like this and you'll be surprised at the number of different parts you'll be able to mill faster and better. Call in a Sundstrand methods engineer. He'll be glad to help you.

SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

2 Production Milling



Here's an entirely different approach to a milling problem. This Sundstrand Model 22 Rigidmil is equipped with a special two spindle head, one vertical and one horizontal. With the addition of the vertical spindle, both the top and one side of these aluminum castings are milled simultaneously in one automatic cycle. Rate of production is approximately 50 flanges per hour. Production milling problem solutions like these are the result of Sundstrand "Engineered Production." This service consists of designing the most profitable processing method first, then obtaining machines to suit this method . . . standard or semi-standard machines if possible, or entirely special machines, if necessary.

3 Special Machining at High Production

Here's a good example of a special machine designed to perform basic milling operations and including drilling and counterboring operations. It is a special 5 station process machine that completes these operations on exhaust manifolds with one handling of the part. All operations are performed at the rate of 113 manifolds per hour.

FREE additional data

For complete information on Sundstrand "Engineered Production" including specific tooling and production data, write for Bulletin No. 602. For more information on Sundstrand Magnetic Fixtures, ask for Bulletin No. 124.

SUNDSTRAND

SUNDSTRAND
Machine Tool Company
2533 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

Machine Against Muscle

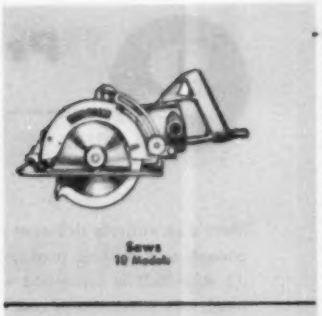
THE STORY OF WHY A FAMOUS COMPANY SEES FIT TO TAKE A NEW NAME

In 1924 the dream of a man named Joseph W. Sullivan was realized in a revolutionary new tool that was to take the industrial world by storm. The portable power saw was born and a young company was off to a flying start.

Inevitably, the success of this new power tool attracted imitators, brought others to the field. In spite of this, Skilsaw, Inc., maintained a leadership which continues to keep it *first* in the field.

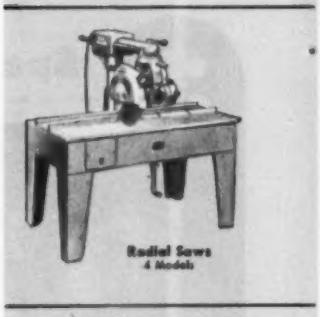
With this remarkable growth came stronger and stronger demand from *all* industry for *other* kinds of power tools built with SKIL Quality, *other* ways to replace muscle with machine and do jobs better, with less work in less time. Skilsaw, Inc., has answered this demand—now offers more than 160 different models of portable power tools, each one an example of the finest engineering and quality in the field—SKIL Quality!

So it is with justifiable pride that we now alter a corporate name we have in simple fact outgrown. Hereafter, the company long known as Skilsaw, Inc., will be known as SKIL Corporation, the name to be remembered in the manufacture, sale and service of portable power tools.



Saws
10 Models

Belt Sanders
5 Models



Radial Saws
4 Models

Valve Rotascrs
3 Models

Saws
4 Models

SKIL Corporation

formerly SKILSAW, Inc.

5033 ELSTON AVENUE, CHICAGO 30, ILLINOIS

BOTH SKIL AND SKILSAW WILL CONTINUE TO BE USED AS TRADEMARKS

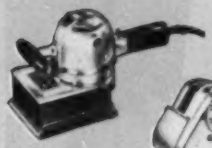
SKIL
PORTABLE TOOLS

Drills
26 Models

Plane
1 Model

Bench Grinders
7 Models

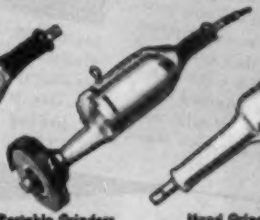
BESIDES SAWS . . . 26 OTHER TOOLS AND



Oscillating Sander
1 Model

Floor Sanders
2 Models

Disc Sanders
6 Models



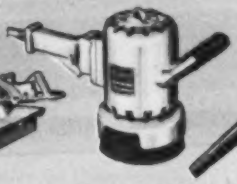
Portable Grinders
5 Models

Hand Grinders
7 Models

Drivers and Runners
20 Models

MORE THAN 150 DIFFERENT MODELS

Radial Supports
3 Models

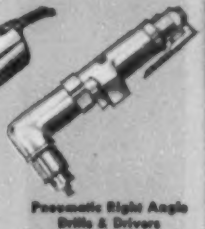


Polyphase Grinder
1 Model

Blowers
3 Models

Electric Hammer
1 Model

Shears
1 Model



Pneumatic Right Angle
Drills & Drivers
6 Models

FOR EVERY INDUSTRY

Valve Seat Grinders
2 Models

Automobile Polishers
2 Models

Valve Seat
Grinder Sets
4 Models

Pneumatic Hammers
12 Models

Pneumatic Drills
7 Models

Pneumatic Drivers
and Runners
12 Models

Pneumatic
Sanders and Polishers
2 Models

INCLUDING THESE SKIL HOME SHOP TOOLS

Belt Sander
1 Model

¼" Drills
2 Models

½" Drills
2 Models

Kits
3 Models

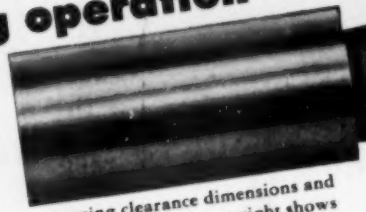
Sander Polisher
1 Model

Oscillating Sander
1 Model

Hedge Trimmer
1 Model

how SURFACE DEFECTS impair bearing operation

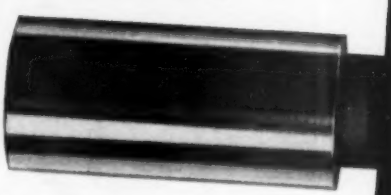
No matter how smooth a ground surface may appear, examination will reveal imperfections in the form of grinder scratches and ridges, feed spirals, chatter marks and partially loosened metal splinters. Upon contact, these minute peaks and ripples interlock with the mating surface of the bearing, tending to rupture the protective oil film. Fragmented metal is torn from surfaces to mix with lubricant and cause abrasive wear, increasing clearance dimensions and shortening life. Photo at right shows an example of a scratched and galled surface which stopped rotation by "plowing" metal.



GISHOLT

how SUPERFINISH insures bearing life

Superfinish removes all surface defects such as grit scratches, feed spirals and the soft "smear metal" caused by grinding heat, and having removed the faulty layer—gets down to metal of the desired structure and hardness. At the same time, it produces a more nearly perfect geometrical form which supports a more efficient oil film for lubrication. There are no projecting defects to churn the oil film or cause metallic contact.



Load carrying capacity is substantially increased by Superfinishing. And bearing life is greatly prolonged.

you should know the facts about

SUPERFINISHING!

It may surprise you to know what a quick and inexpensive process Superfinishing really is. It can greatly reduce the cost of grinding and, in many cases, eliminate such expensive operations as hand lapping and polishing.

If you have not yet read the booklet "Wear and Surface Finish," we will be glad to send you a copy of this authoritative text book with our compliments. Please request it on your company letterhead.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

VOTE FOR CIMCOOL

for 85% of all metal cutting jobs!

And it's a landslide for Cimcool® when these facts also go on the record: this radically new and different cutting fluid lowers costs . . . permits faster speeds . . . increases accuracy . . . and helps increase tool life.

Cimcool wins a sweeping victory over old-fashioned coolants because it's a *chemical emulsion.* It replaces all water emulsions and all but a few highly compounded specialty oils. Cimcool permits faster speeds and increases tool life because it combines friction reduction and cooling capacity in a degree never before attained. It's longer lasting in machines. So Cimcool reduces downtime and cuts labor costs for cleaning and changing.

We know you'll give Cimcool a vote of confidence after a demonstration in one of your own machines. For that demonstration, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "CIMCOOL Defeats Heat". Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS

Versatility
with a NORTON 10x20" UNIVERSAL GRINDER

The versatility of the NORTON 10 x 20" Universal Grinder goes beyond efficient performance of external, internal, face, and angular wheel feed grinding.

Head and footstock positions are interchangeable permitting simplified set-up on jobs involving shoulders or spacers. Set-ups are made easier on chucking jobs by the D1-3" camlock nose on one end of the headstock spindle which permits permanent chuck mounting. The chuck is quickly positioned by swivelling the headstock.

The headstock spindle is designed to take a workpiece up to 1" diameter clear through. This permits an extra long piece to be ground by chucking at one end and passing the remainder through.

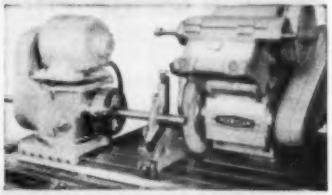
For ease of set-up, the internal spindle is a hinged-bracket type, attached to the front of the wheel slide. This spindle is quickly swung into position for internal grinding—or is as quickly swung out of the way.

The wide versatility of this machine demonstrates again how you economize when you modernize with a new NORTON Machine.

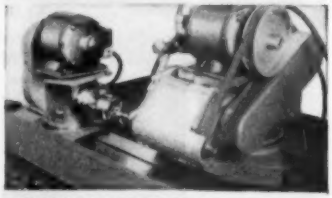
Additional features are described in Catalog 170. Write for your copy today.

INTERCHANGEABILITY permits reversing head and footstock positions to eliminate necessity of changing wheel and drive to other end of spindle.

CONVENTIONAL or **SPEED CHUCKS** may be left permanently mounted on one end of headstock spindle. Headstock quickly swivelled 180° to bring chuck into position.



HOLLOW SPINDLE in **HEADSTOCK** allows work up to 1" in diameter (and which is longer than machine) to be passed clear through.



COMPOUND WHEEL SLIDE permits swivelling of wheel head to any angle and wheel feed at any angle.

To Economize Modernize with NEW **NORTON** GRINDERS and LAPPERS

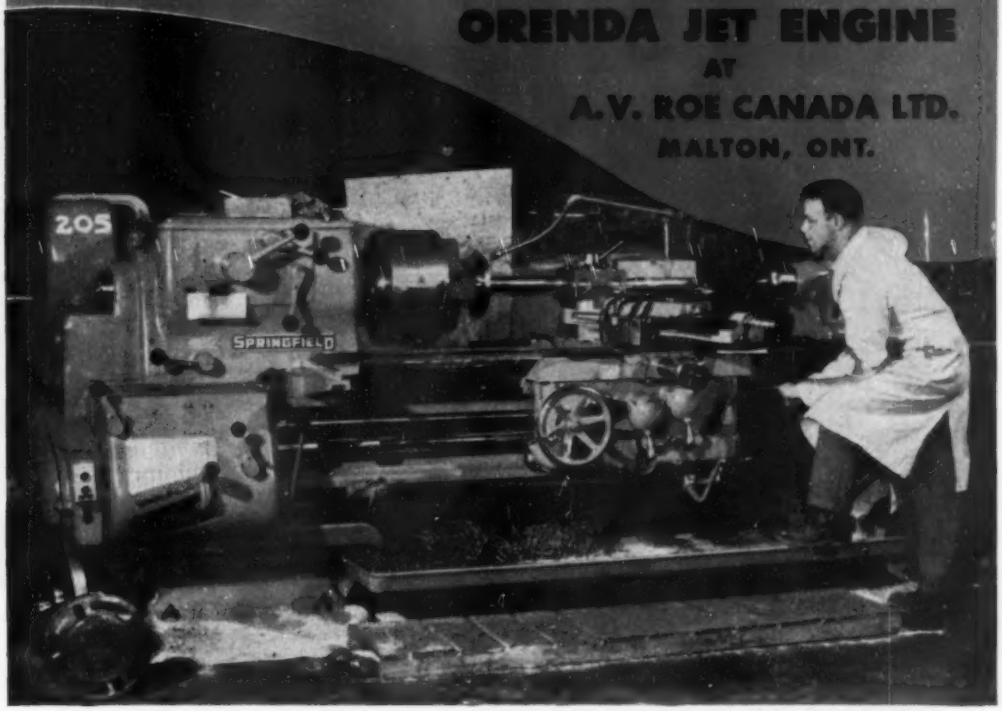
Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASS., U. S. A.

DISTRICT SALES OFFICES: HARTFORD • NEW YORK • CLEVELAND • CHICAGO • DETROIT

SPRINGFIELD LATHES

TURNING PROBLEMS SOLVED ON ORENDA JET ENGINE AT A.V. ROE CANADA LTD. MALTON, ONT.



SPRINGFIELD CONTOURING LATHE BORING INTERNAL PROFILE ON STUB SHAFTS FOR ORENDA JET ENGINE

The precision and high productive capacity of Springfield Lathes makes them ideally suited for the rigid demands of Jet Engine production.

Years of experience adapting engine lathes to the production of all types of work has enabled us to build into Springfield Lathes the quality which assures top performance in operation.

Benefit by our long experience through the advanced design, sturdy reliability and production capacity of Springfield Lathes.

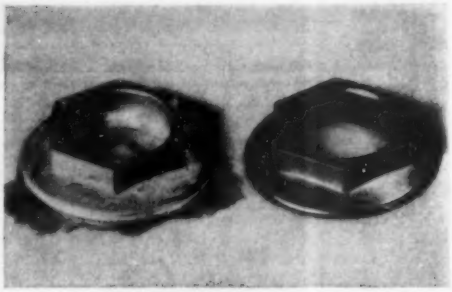
THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

EXCLUSIVE REPRESENTATIVES IN ALL PRINCIPAL CITIES

What Does Barrel-Finishing With ALUNDUM* TUMBLING ABRASIVE Offer You?



Typical die casting before and after tumbling with ALUNDUM Tumbling Abrasive.

A variety of parts before and after barrel-finishing with ALUNDUM Tumbling Abrasive. Included are castings, forgings, stampings, and machined parts.

- It provides you with a fast, clean, economical method for finishing your metal parts to exact dimensions and degrees of surface finish.

- It enables you to remove burrs, flash, tool marks, and heat scale from large quantities of stampings, die castings, and forgings quickly and inexpensively.

- It eliminates many slow hand-finishing operations, increases production, saves time and money.

- If you don't have barrel-finishing equipment in your plant, Norton will make test runs for you, without obligation, to show you what this process with ALUNDUM Tumbling Abrasive can do for you.

A Tip on Barrel-Finishing

Don't forget that oily parts should be thoroughly cleaned before barrel-finishing. They retard the abrasive action and make it impossible to obtain bright finishes.

Norton Booklet, Form 501, "Barrel-Finishing with Alundum Tumbling Abrasive" is packed with useful information. Write for your free copy.

NORTON COMPANY
Worcester 6, Mass.

Distributors In All Principal Cities

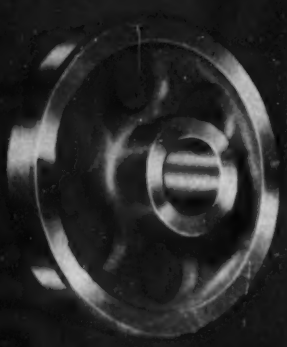
NORTON
ABRASIVES
Making better products to make other products better

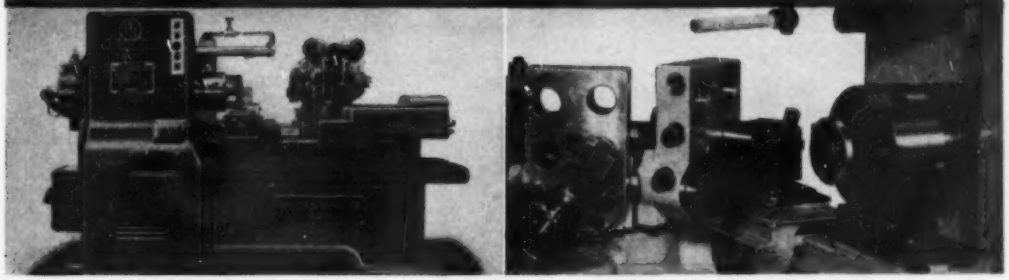
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

ONE OF THESE PIECES

EVERY 1.84 MINUTES

POTTER & JOHNSTON 3U *SPEED-FLEX*





High output with high precision on difficult jobs is the rule, not the exception, with industry's outstanding production team, Potter & Johnston Automatic Turret Lathes plus P & J Tooling. A job like that shown above is a good example, not because it's unusual, but because it's the sort of work the 3U takes in its stride. All machining operations on these phosphor bronze drive worm wheels are completed in one automatic cycle. They include both inner and outer rim faces as well as the inner end of the hub. Tolerances on some surfaces are held to five ten-thousandths of an inch. One operator easily handles a battery of machines, providing divided labor costs. Production of small, precision parts in your plant can similarly be speeded up — made more efficient. Send now for your copy of Bulletin 145 that fully illustrates and describes the Potter & Johnston 3U Speed-Flex Automatic. Ask P&J Tooling Engineers to make a time and cost estimate for your difficult jobs. They will work out the best possible tooling for better quality, lower costs and fewer rejects — and there is no obligation.

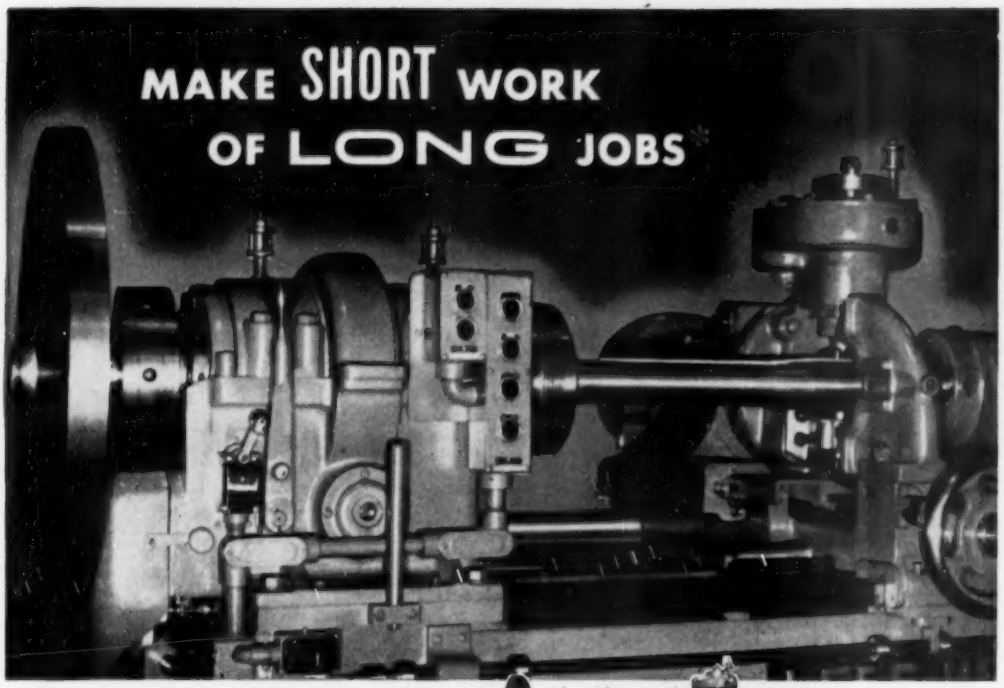
Precision Production Tooling for over 50 years

POTTER & JOHNSTON COMPANY

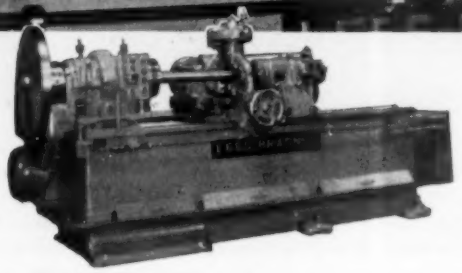
PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY — DIVISION NILES – BEMENT – POND CO.

MAKE SHORT WORK OF LONG JOBS*



with the Lees-Bradner *End Loading* SH SPLINE HOBBER



*The SH hobs splines up to 144".

The exclusive Lees-Bradner "feed through spindle" feature enables the SH spline hobber to handle long and bulky parts with maximum efficiency and speed. It also provides the necessary support for long splines of small diameter.

The SH will hob splines up to six inches in diameter and can handle spur and helical gears up to eight inches.

Let Lees-Bradner, the first name in hobbing, be your first thought when you have a hobbing problem. Your Lees-Bradner representative will be happy to consult with you without obligation.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

UNION TWIST DRILLS are made in the broadest range of types, to cover every drilling operation — no matter what your material or drilling equipment may be.

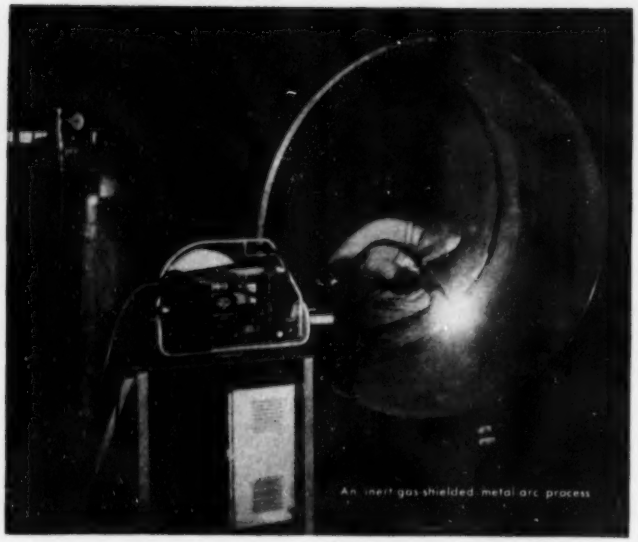
For fast, free-cutting performance, minimum breakage and more work between re-sharpenings, see your Union Distributor for the drills that are *right* for *you*.

FIRST TEAM IN CUTTING TOOLS . . .

UNION *and your Local Distributor*

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS • Milling Cutters • Gear Cutters • Twist Drills • Hobs • Reamers • Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers, Twist Drills BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates

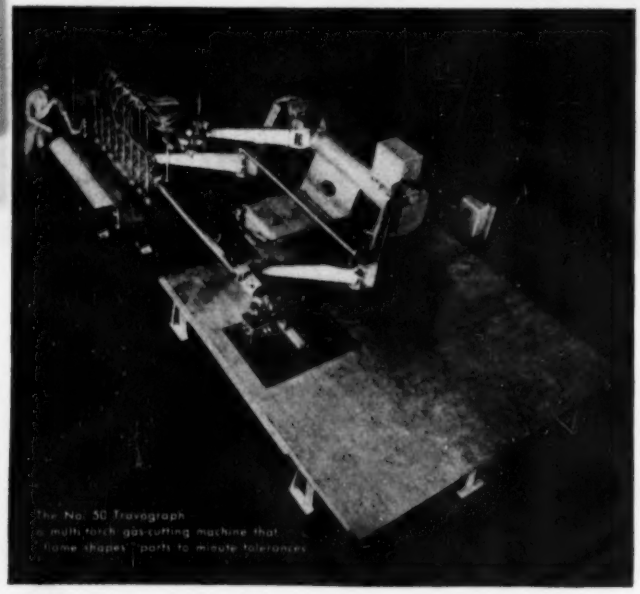


AIRCOMATIC® WELDING

for hard-to-join metals

- Continuous high-rate deposition of filler metal
- Welds aluminum, bronze, nickel, stainless & carbon steels
- No flux required — no slag removal
- Minimum plate-edge preparation
- Heavy section welding with little or no preheat
- No "blind" welding — always a visible arc
- A semi-automatic operation with the versatility of all-position welding

AIRCO PRESENTS THE LATEST



TRAVOGRAPH® CUTTING

for mass producing intricate shapes

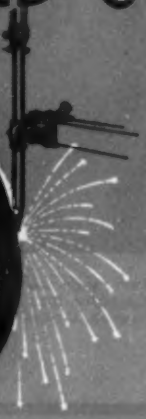
- "Electronic bloodhound" tracing device accurately reproduces template or outline drawings
- Handles light plates, heavy slabs, billets or forgings
- Straight cutting, beveling or squaring
- All-welded construction for durability and precision
- Torch arm will support up to 8 cutting torches
- Precision shapes up to 102" x 144" — circles up to 12' in diameter — with one 16' set of rails. Cutting length extended with additional rail

at CONVENTION HALL
in PHILADELPHIA

Airco will bring you an "operators-eye-view" of the Aircomatic welding process . . . a continuous "live" demonstration of the #50 travograph. Here's a rare opportunity to view the latest in welding and cutting equipment! Movies . . . Exhibits . . . Welding Apparatus . . . Stationary and Portable Cutting Machines . . . Gas and Arc Welding Accessories.

IN WELDING AND CUTTING!

SEE 'EM IN ACTION!
THE
NATIONAL METALS
CONVENTION
OCT. 20-24
BOOTH 1623

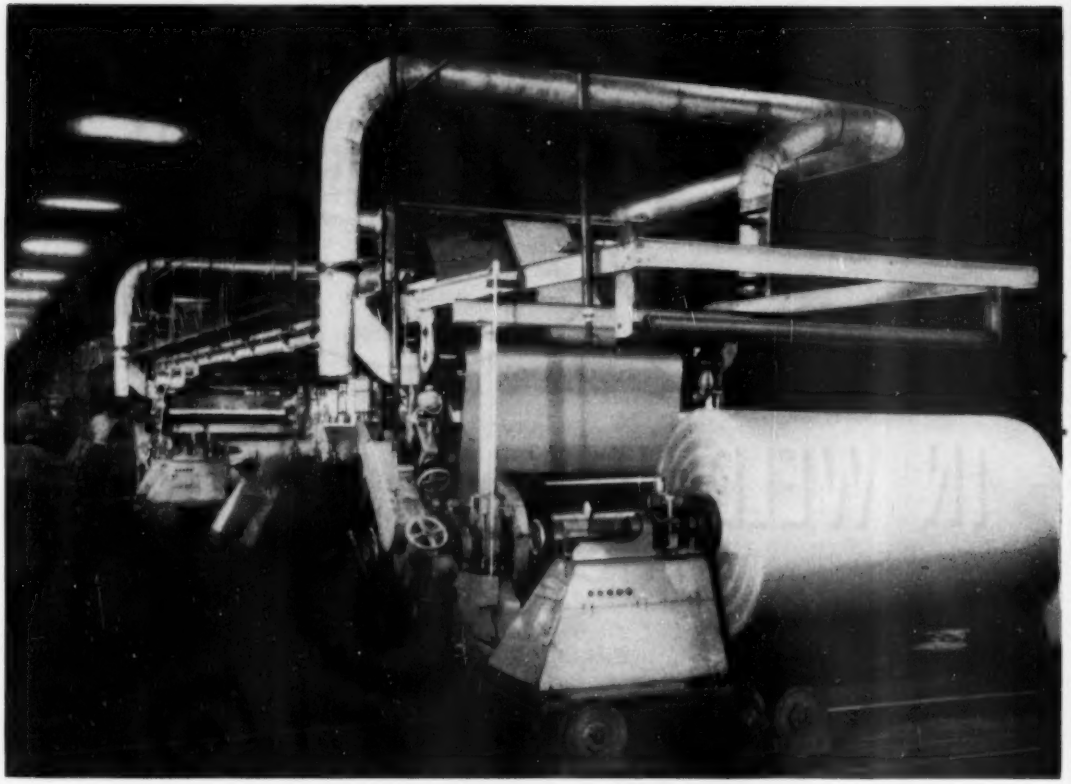


AIRCO
DEALERS AND OFFICES IN MANY PRINCIPAL CITIES

AIR REDUCTION
AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY • AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
DIVISIONS OF AIR REDUCTION COMPANY, INCORPORATED
at the frontiers of progress you'll find

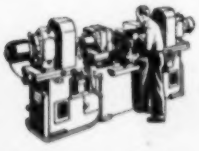
LINK-BELT ball and roller

... keep company with America's hardest-



The bearings for this Swift Single and Double-Facing Corrugating Machine, in operation at Connelly Containers, Philadelphia, must meet such varied conditions as heavy pressures, high temperatures and close precision. Over 60 Link-Belt Bearings of various types and sizes are used.

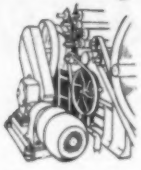
LINK-BELT ball and roller bearings



Metal Working Machinery

Farm Machinery

Construction Equipment



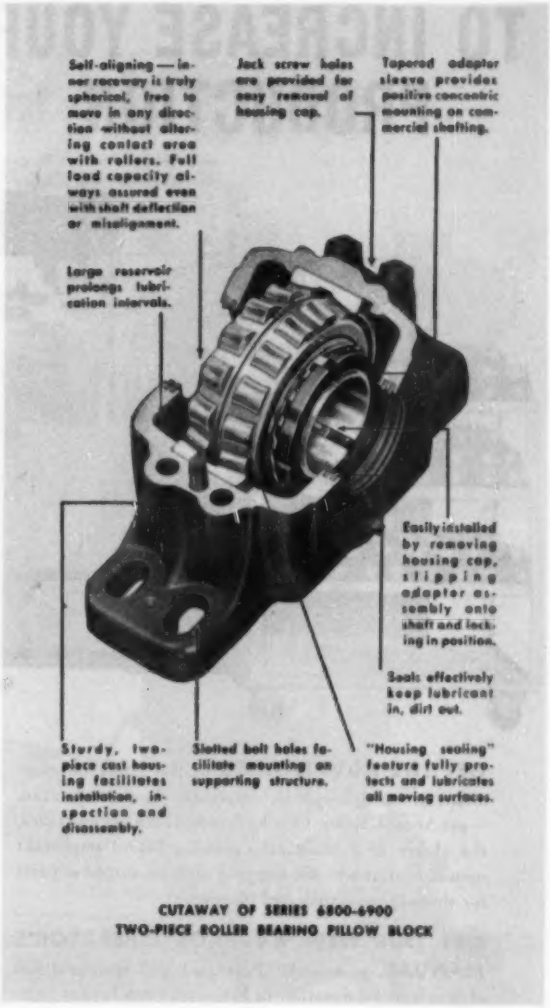
Textile Machines

bearings
working machines

YOU can always rely on Link-Belt Ball and Roller Bearings. Built to the highest standards of modern precision manufacture, they assure long-life, free-rolling shaft support — even with shaft deflection or misalignment.

And you can get a size and type to match your exact bearing requirements. Link-Belt builds a complete line of industrial mounting designs—pillow blocks, flanged, flanged cartridge, cartridge, hanger and take-up blocks — in addition to unmounted bearings.

For application information, get in touch with a Link-Belt bearing engineer. Complete engineering data is also available in Book 2550.


Self-aligning — inner raceway is truly spherical, free to move in any direction without altering contact area with rollers. Full load capacity always assured even with shaft deflection or misalignment.
Jack screw holes are provided for easy removal of housing cap.
Tapered adapter sleeve provides positive concentric mounting on commercial shafting.
Large reservoir prolongs lubrication intervals.
Easily installed by removing housing cap, slipping adapter assembly onto shaft and locking in position.
Seals effectively keep lubricant in, dirt out.
Sturdy, two-piece cast housing facilitates installation, inspection and disassembly.
Slotted bolt holes facilitate mounting on supporting structure.
"Housing seating" feature fully protects and lubricates all moving surfaces.

CUTAWAY OF SERIES 6800-6900
TWO-PIECE ROLLER BEARING PILLOW BLOCK

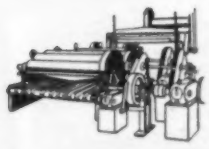
LINK-BELT

BALL and ROLLER BEARINGS

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, Factory Branch Stores and Distributors in Principal Cities.

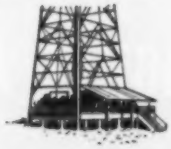
12.001

smooth the path of power for all industry

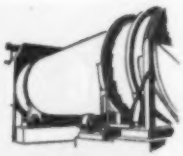


Pulp & Paper Machinery

Materials Handling Equipment

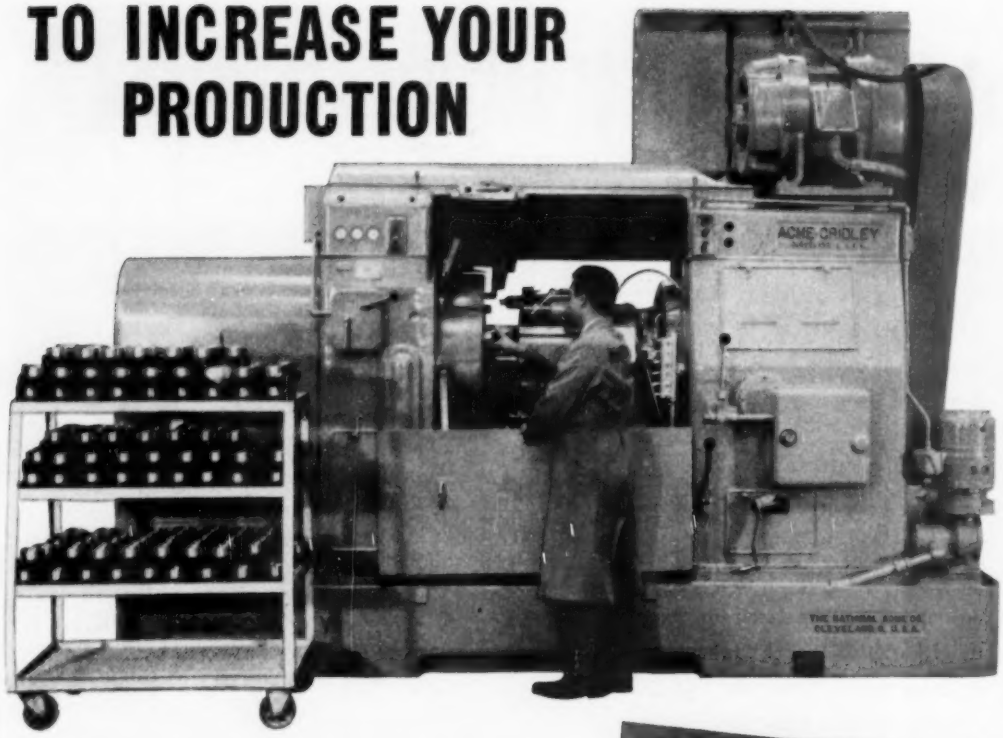


Oil Field Equipment



Processing Equipment

TO INCREASE YOUR PRODUCTION



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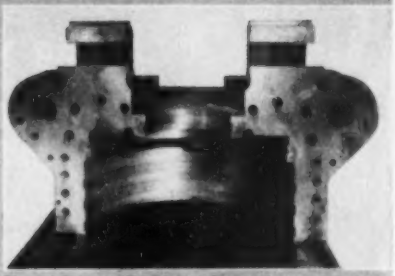
This powerful Cincinnati Bickford Super Service Radial Drill was purchased to facilitate handling of "big work." It was the right machine for the job. In the complete line of Cincinnati Bickford Radial Drills, with their many outstanding features, is the right machine for you.

Write us for descriptive literature, or consult our Engineering Department on drilling needs.



Photos—Courtesy Worthington Corporation, Steam Turbine Division, Wellsville, N. Y.

Here 3" pipe tap holes are being drilled and threaded in 3000KW Turbine Generator End Casing.

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THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

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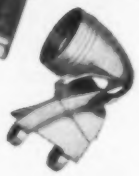
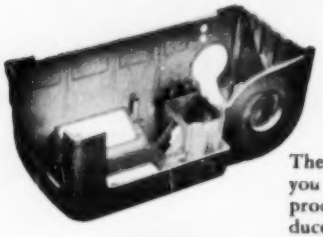
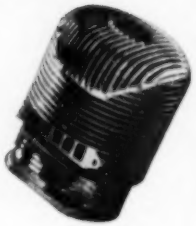


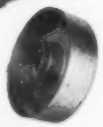
all your requirements for profitable die casting can be met with the

Model 400 CLEVELAND

Die Casting Machine





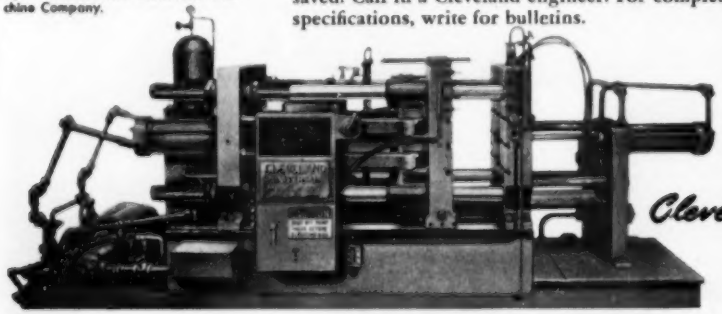


The Model 400 Cleveland Die Casting Machine will give you precision quality castings at a highly profitable rate of production. Castings may range in size from tiny parts produced in multiple cavity dies, to single castings weighing as much as 16.1 lbs. in zinc, or 7.5 lbs. in aluminum. *Universal* in design, the Model 400 can be quickly converted from zinc, tin or lead casting to aluminum, magnesium or brass casting, by changing the hot metal end.

Cleveland design gives you easy access to dies; ample die area; sure-fire shot mechanism; rapid, positive core pull and ejection; safe and simple control—either manual or automatic. Heavy, rigid construction and massive toggle linkage lock dies with tremendous pressure. Cleveland's high injection speed and pressure produce sound, dense, *hardware finish* castings. Dimensions are held to close tolerances; cored sections are precision-cast.

The nation's leading producers of die castings rely on Cleveland dependable performance—for around-the-clock production! You should find out now how Cleveland machines can improve *your* die casting production with money saved. Call in a Cleveland engineer. For complete machine specifications, write for bulletins.

Cleveland Model 400 High-Pressure Hydraulic Die Casting Machine. 36" x 38" die plates; 400 tons locking pressure. Die casting machines of smaller capacities are also produced by The Cleveland Automatic Machine Company.



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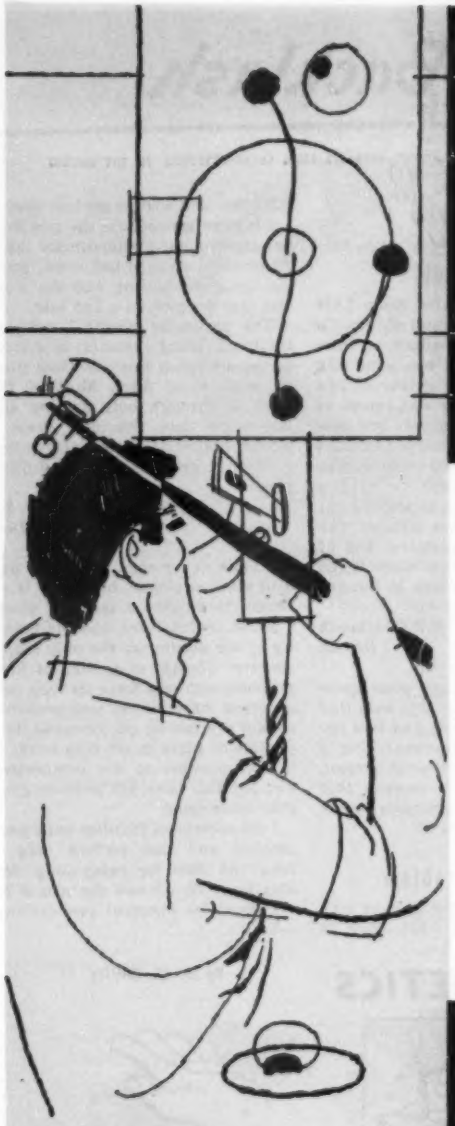

ARE YOU *HAMMERING* YOUR DRILL TOOLS INTO THE SCRAP PILE?

Tools on the scrap pile mean profits out the window. Then why let drills be pounded into scrap by the old-fashioned hammer-and-drift method of removal?

Fosdick Drills, equipped with Tool Ejectors, eliminate the need for hammers and drifts. The operator simply engages the Tool Ejector, grasps the tool with one hand and withdraws the spindle with the other. There's virtually no possibility of tool points striking the table. Operators save the time formerly spent groping for unnecessary tools. Drill, tap and reamer shanks stay smooth, keep your tools running right on center.

You don't need attachments—it's all done without special chucks, using standard taper shank tools.

THE TOOL EJECTOR is another "first" from Fosdick, design leader in drilling machinery, and *first* to apply hydraulics to Radial Drill controls. Remember, only Fosdick can equip its drills with the Tool Ejector.

CALL YOUR DISTRIBUTOR FOR MORE INFORMATION OR WRITE CINCINNATI DIRECT.

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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Hot Spot

You mention in Talking Shop (*AM*—Aug 4 '52 p143) that Rover Co has brought out a gas-turbine automobile. I think there was some talk about this possibility a year or two ago and the question was raised as to the danger to other cars and people in the rear from the hot exhaust blast. Has Rover found some way to eliminate this danger? Or is this purely a research job to see if a car can be driven by a gas turbine? The 152 mph sound impressive, but of much more interest is whether it can roll along at 40 or creep in Sunday traffic at 20 or less.

P R Overbrook
Detroit

Sorry we can't answer your questions. Our information was only that the car had been built and had operated. We assume, however, that it is, at present, only a research project, but it is from such research that tomorrow's cars eventually come into being.—Ed.

Drilling Problem

I am deeply interested in your article on gun drilling (*AM*—May 26 '52, p109) and wish to get tear sheets.

I believe we can use the gun drill principle on our plastic camera cases. At present, we drill and ream, using the usual equipment, but the wear and tear on tools is a sad tale.

The particular plastic I wish to try it on, using carbides, is a compression-molded thermosetting plastic with wood filler. Most of the work is through hole drilling and not more than five dias deep. I would appreciate any information you could give me on gun drilling plastics.

A F Parker, Sr.
Ann Arbor, Mich.

We have never seen a carbide gun drill used in plastic, but there is no reason to believe it will not work. Coolant, or lubricant, and the porosity of the plastic are the only major concern. Coolant is applied at high pressure and may force its way into a porous material. As you probably cannot use cutting oil, kerosene, turpentine or plain water may work. It is also possible to use compressed air, but this does not provide good chip scavenging.

I am somewhat familiar with your product and can picture only a hinge-pin hole as being only five dias long. This hole's dia would be too small for practical gun drilling. —Ed.

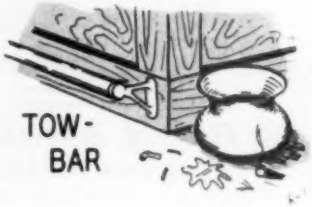
GRINETICS

By D. G. SMITH

BRIEF CASE

R.H. SHOWN, L.H. OPP.
(MAKE L.H. PART ONLY)

TIME CLOCK



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If your operation requires the generation of accurate cylindrical or flat surfaces.

Hundreds of industrial plants have found that Microhoning not only improves the quality of the surface, but also increases production—reduces scrap, handling, and inspection costs.

No, you do not need a crystal ball.

The potentials of the Microhoning process can best be judged by the past accomplishments and present policy of the organization that developed it.

To give industry a complete service, the Micromatic Hone Corporation has an organization and sales policy unique in the machine-tool business. One well-coordinated organization sells, engineers, builds, and services the complete installation. Micromatic assumes full responsibility for all the equipment and the results obtained with the Microhoning process.

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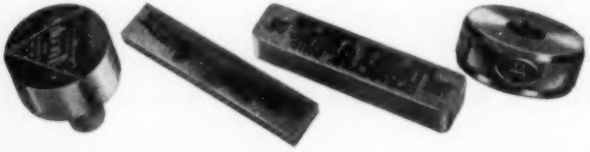
Because Noblewest has kept pace with industry's demand for constantly higher marking speeds and lower costs per unit marked . . . Noblewest is, today, the world's leading manufacturer of rapid precision equipment for the permanent marking of metal, plastic, hard rubber, wood. Model 137 (illustrated), with new improvements, can be tooled for marking many sizes and shapes of pieces.

Noblewest is equally famed for fine marking dies . . . made to the most exacting standards of quality and with the all-important skill and know-how of master craftsmen. For good impressions and long service, only the very finest of steel, carefully heat-treated, is used.

Whatever your needs for marking, Noblewest makes the machines, tools and dies to do the job faster, better, at lower cost. For complete details write to Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

A MARK IS ONLY AS GOOD AS THE DIE THAT MADE IT



MARK IT BEST WITH NOBLEWEST Roll-O-Matic MARKING

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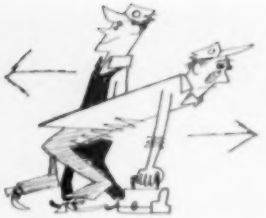
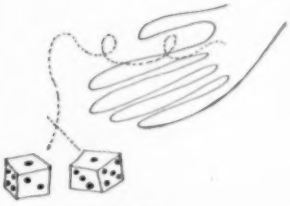


No Rest Needed

The discussions on running more than one shift have been very interesting, and I was naturally much pleased with Lucien Yeoman's remarks (*AM*—Sept 1 '52, p186) regarding the use of overlapping supervision on double and triple shifts. I am glad that Lucien is still interested in such problems as, of course, he should be. While he is not quite in my age class, he has had a lot of experience and it is gratifying to have him quote from one of my books regarding this problem.

While many feel that multiple shifts should be avoided, where possible, we should not overlook the fact that expensive machine-tool equipment earns no dividends while it is idle. The sooner a machine can be worn out in production, the better investment it becomes, both because of its earnings and because it can then be replaced by a newer and better one. Some formerly contended that machines needed a rest as well as the men who ran them, but this idea was pretty thoroughly exploded many years ago in the columns of AM.

Fred H Colvin
Point Pleasant, N J



No Dice

You have published a number of excellent articles on die design, including drawings of some extremely interesting and complicated dies. Unfortunately, you do not give all views and cross-sections, and often do not give any dimensions. Several times, you have shown dies that we might have used for making quite similar parts if we had had detailed dimensions for building the die.

Would it be possible for us to bor-

The Reader AUDITED PAID CIRCULATION ABC *His Mark*

THE ABC SYMBOL which is printed at the head of this page is, in a very real sense, *your* brand on this magazine. Those letters stand for Audit Bureau of Circulations. The symbol indicates that the magazine is a member and supporter of that Bureau.

To the advertiser who contemplates using the magazine as an advertising medium, this symbol has a well-recognized significance. It tells him that the circulation records and practices of the magazine are wide open to the auditors of the Bureau, who check the publisher's claims and make public the precise terms and conditions under which subscriptions are obtained. And it assures him that the magazine stays in business by virtue of a demonstrated demand from its readers as shown by their paid subscriptions or newsstand purchases.

BUT HERE we are concerned only with the significance of ABC to you as a reader. For when the advertisers, the advertising agencies, and the publishers founded the Bureau nearly forty years ago to help establish honest circulation figures, they unwittingly set up a cooperative institution that has become a major safeguard for the interests of the reading public.

That is because membership in ABC constitutes one of the strongest guarantees that any publication can offer of its primary devotion to the interests of its readers. And by making that guarantee possible, ABC becomes a major safeguard of the freedom of the press, an objective of exceptional importance in these days when the public is flooded with propaganda from so many sources.

THE SUREST MEANS by which to preserve a free press is to keep it directly answerable to the reading public it would serve. It follows, then, that the survival of a truly free press must depend on its acceptance by that public; and that means in turn that the people must have in their hands some adequate means for holding the publishers responsible to them.

No one has yet devised any means to that end more simple, more direct or more practical than the paid subscription or newsstand purchase price. The right to purchase or refrain from purchasing a publication gives to the readers and to no one else the power to pass judgment on whether that publication should continue to serve the reading public.

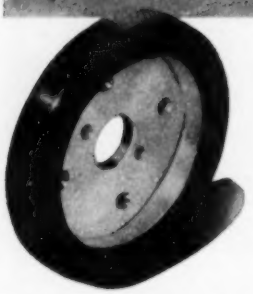
TO SUPERVISE this vital process, to check and certify the integrity of the publication's circulation methods and claims, requires a strict and continuing audit of each publication's success in meeting this test of its public acceptance. To that essential function the ABC has contributed mightily by the conscientious performance of its mission. And that is why we are able to have a press supported, for the most part, by advertising revenues, but not controlled as to its circulation or content by any influence other than its readers

When an advertiser consults the ABC statement of a publication to ascertain the amount, the quality and the trend of its circulation, he does so in the legitimate pursuit of his own interest. But at the same time, inevitably, he is helping the ABC to keep the press responsible and responsive to the reading public. For, in effect, he is asking the publication to demonstrate through its circulation figures that it owes its standing to a voluntary demand by its readers.

SO THE Audit Bureau of Circulations, by auditing and certifying paid circulations, has come to perform a vital service to the readers of this magazine and of every other member publication. And in performing that service, it helps to maintain in our country a press that is answerable to the reading public and to it alone. So long as the practices and principles for which ABC stands continue to prevail in American publishing, we shall find in it a sure support for a truly free press, responsible only to the public it serves.

McGraw-Hill Publishing Company

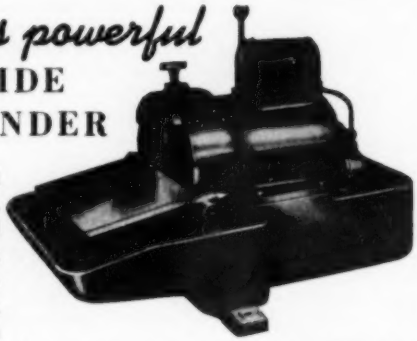
Grind More Carbide per Carat of Diamonds



...with STEEL-BONDED DIAMOND WHEELS

Wickman-Neven Steel-Bonded Diamond Wheels stretch wheel life—lower your carbide grinding costs because they're practically indestructible. They can't be damaged even by plunging sharp-pointed tools into them. Diamonds stay in place until worn to give more cuts per carat. These wheels also give up to 300% longer carbide tool service by producing a strong, uniform cutting edge that resists breakdown.

...and this powerful CARBIDE BENCH GRINDER



Ideal for all off-hand carbide tool grinding, the Wickman Model GF-2A is heavily built for years of service even by unskilled help. The 1 HP direct-drive motor is quickly reversed, and the wheel guard swivels for right- or left-hand grinding. A built-in coolant pump delivers 12 GPH; primer and strainer are also included. This machine comes furnished with a steel-bonded diamond wheel of your choice. Protractor also available.

write on your letterhead for this new 24-page catalog Resinoid-Bonded Diamond Wheels and Wickman grinders. For the Complete story on Steel-Bonded Diamond Wheels.

THE Wickman MANUFACTURING CO.

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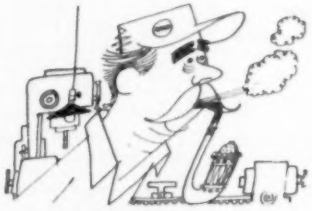
row the original drawings from which your sketches were made? We would return them in a few days, as soon as we had obtained the complete information. If this is not possible, would you give us the names and addresses of the people who originally made them, so we can get in touch with them direct?

J Swanson
Birmingham, Ala.

These drawings are published to show the principles of the die operation, not the details. When a company has spent hundreds of hours in design time, we could not presume to give away the results to a third party. That would be a poor return for the generosity that permitted us to publish the article in the first place. We shall be glad to give you the address of the maker of any die that interests you, but fear you will have no success in obtaining free design service.—Ed.



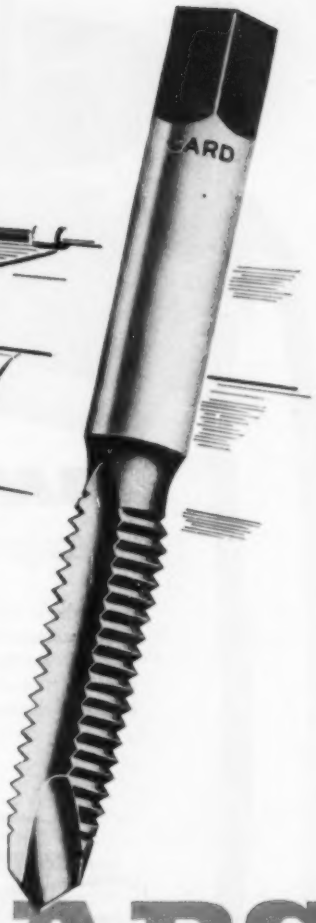
It's Up To You

Some time ago, you published several articles from foreign countries which, permit me to say it, were a source of great satisfaction to us on this side of the Atlantic. They showed that we, too, have ingenuity and experience in production.

There appears now to be an end to these articles, and I venture to ask whether the political situation has influenced this in any way. Whatever may be the decisions of our various governments, we, as skilled machinists, should enjoy a form of international brotherhood. We can and do learn much from you, but we feel that there are still some things that you might learn from us if you give us the opportunity of setting them forth in your magazine.

R Potdevin
Liege, Belgium

The fault is not ours, but that of your compatriots who have failed to send us any more articles for publication. Our pages are always open to contributions from any country, provided the material is of interest to our readers.—Ed.



Card boosts production from 90 holes per tap to 18,000!

CARD TAPS

Producing armament parts for the government, a large metal-working firm was tapping extruded holes in thin steel for size 3/8-24 screws. Taps used were Card three-flute, spiral pointed, high speed steel, commercial ground. Due to the low carbon, low sulphur content of the steel part, it became welded to the taps after 48 to 90 holes — so that holes were reamed or drilled out, leaving no threads.

Card technicians tried various cutting oils and other styles of taps without effect. Then, deciding that a dissimilar metal was needed between the tool and the work, they recommended chrome-plating the taps.

Results: The chrome-plated taps averaged 18,000 holes each, perfectly tapped to a No. 2 fit. One tap completed 35,000 holes.

SEE YOUR CARD DISTRIBUTOR FOR PROMPT DELIVERIES AND HELPFUL SERVICE

Your Card representative, backed by Card's expert engineering staff, is always available for aid in any tapping problem. S. W. CARD MANUFACTURING COMPANY, Mansfield, Massachusetts. Division of Union Twist Drill Company.

The CARD Quality

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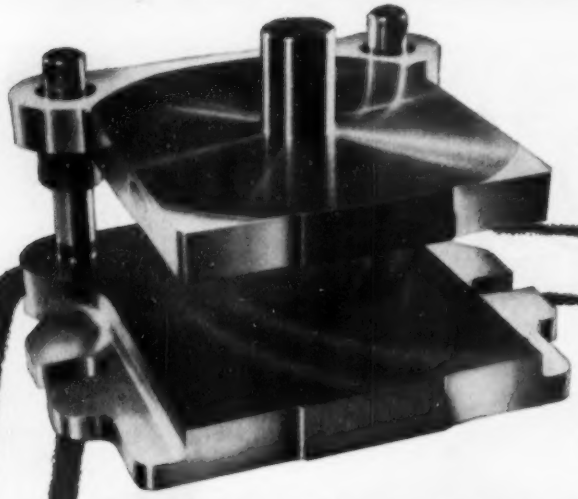
Production Proved For Lasting Accuracy

Also makers of DIES • SCREW PLATES • DIE STOCKS TAP WRENCHES



DANLY DIE SETS

helped FORD retool for '52

Somewhere behind the scenes in almost every outstanding mass production operation, you'll find Danly Die Sets at work . . . saving time in the die shop and assuring longer production runs in the press room. Danly Die Sets are the first choice of diemakers everywhere.

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Get your DANLY DIE SETS from your conveniently located DANLY BRANCH ASSEMBLY PLANT

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**Indicates complete stock*

DANLY

DIE SETS AND DIEMAKERS' SUPPLIES

SPOT NEWS of Metalworking

- **Space travel may be still a dream, but** a refrigerating-equipment manufacturer has done some experimental and development work—not as yet released—on devices to keep airship skins cool. Friction heat is the third big problem in space-travel trio that includes metal strength and power.

- **French are showing a jet-powered prototype automobile.** Power plant is a 100-hp gas turbine that drives the car at 120 mph. US companies have shown interest in the idea, but not in this particular design.

- **New rip-proof conveyor belt** has special carcass with multiple strands of high-tensile-steel wire imbedded crossways at three-foot intervals. Belt is made for applications where tears and punctures are unavoidable; steel wire stops rips from spreading.

First commercial (non-defense) cold-extrusion steel plant will use two 2000-ton presses and four 6000-ton presses with 36-in. strokes. Capacity will be products up to 30 in. long, weighing 50 lb. Cold extrusion produces cylindrical pieces with hardness, precision, and high finish without using high-alloy steels.

- **Russians are releasing production of Niles works in Eastern Germany**—the first machine tools to come from behind the iron curtain in two years—evidently to turn over some quick dollar cash.

- **Brazil is exporting machine tools to US.** First lot is lathes, believed to be the first ever sent to this country by Brazil. The standard engine lathes are made entirely from Brazilian materials except for US-built roller bearings in the headstock.

- **British and Australian armies are testing jeep with Holden engine,** also Rolls Royce engine. Holden is Australian-built GM civilian auto. Holden engine is installed normally except for special adapter plates in gearbox; Rolls gear box is revised to double operating speed. Rolls engine develops 90 hp, Holden 85.

- **New machine for cold-reduction of steel tubing** takes 10-in. tube down to 9 in., 18-in. stock down to 16 in., and anything in between. Equipment is 100 ft long. Largest similar machine to date had capacity of 6¼ in.

- **Copper splitting—done in Holland but new to US**—produces flanged parts without fusion or assembly. Tapered shear blade splits blank edge to given depth and spreads halves to 90°. Process may be applicable to other materials, though Dutch company only makes the flanges of copper, some of which are being imported.

Aircraft industries show least labor turnover in any key industries—4% per month. Automotive industry has 6%, shipbuilding 13%. Record is better than during war, when government restricted changing jobs by law.

- **First off-shore contract to close is with Vickers Supermarine** (England) for 300 Swifts. Delivery date—1955—must be met. Vickers got the contract because they were one of few producers who would guarantee delivery on time.

- **Foam plastic developed by Lockheed** is to be filled into cavities in aircraft to provide strength. Weight can be varied from 1½ to 35 lb per cu ft. Best feature: plastic will fill any odd-shaped cavity, and can be blown through small holes into larger openings.

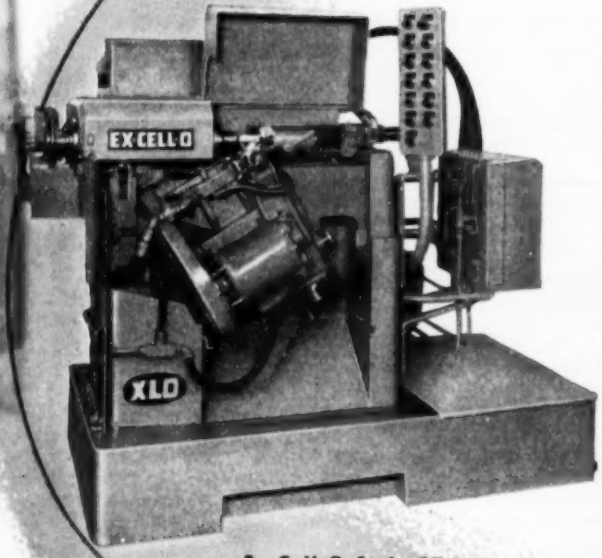
- **Direct-drive hydraulic torque converter for heavy-duty trucks** eliminates 99% of forward shifting in off-highway operations. Most grades can be made by setting mechanical gear ratio, then allowing converter to shift torque delivery to meet load conditions.

FOR PRECISION IN VOLUME JET BLADE PRODUCTION . . .

EX-CELL-O

Air foil forms of jet compressor blades are speedily and accurately ground on the Ex-Cell-O Precision Profile Grinder.

MACHINE GRINDS COMPLETE AIRFOIL



Ex-Cell-O Style 87 Precision Profile Grinder

For precision in volume jet blade production, you'll want the complete "Ex-Cell-O Package" of jet blade finishing machines, including this Style 87 Precision Profile Grinder. Like the Style 85 Two-Wheel Form Grinder, the Style 86 Profile Miller and the Style 88 Profile Polisher, this machine is production-proved.

The complete airfoil form, including leading and trailing edges, is accurately and rapidly ground on the Style 87. All operations, except loading and unloading, are automatic. An important feature is the automatic control of the two-speed work drive motor which slows down while the broad areas of the airfoil are ground, speeds up for grinding the leading and trailing edges.

For further details on the Style 87 and other Ex-Cell-O jet blade finishing equipment write, wire, or phone Ex-Cell-O in Detroit today or contact your local Ex-Cell-O representative.

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EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

52-21

Washington

Controls may be gone by June 1. Fight to save them already has started. But Congress and the new administration will decide issue after January 1. Present betting: Congress won't stand for anything but priorities for military orders, no matter who is president.

• • •

Defense-Mobilization Boss Fowler is spearheading the early push for renewal of all controls—price and wage, which expire March 31; materials regulations, which die June 30.

Fowler's case for renewal is that we've just started the mobilization job. That's the theme of his first quarterly report as head of ODM. The report doesn't plead for controls directly, but it marshals all the reasons why they may be needed.

• • •

Biggest job ahead is expansion of our industrial capacity, Fowler contends. This is largely a matter of getting the additional tools and machinery needed to turn out arms at all-out war rates. But Fowler also wants some materials—more aluminum, steel castings, etc.

Wide government aid in tooling up for war is contemplated by Fowler: loans, fast tax amortization, even some government installation of facilities for private operation. These would go for long-lead-time equipment, like intricate machine tools, steel-casting facilities, armor-plate rolling mills.

• • •

ODM's production-equipment (Vance) committee is working on just such a scheme. Report by Vance group recently—which Fowler is still keeping under wraps—was effort to induce the armed services to spend more for long-lead tools for arms plants.

Little new plant is involved. New tools would be installed largely in existing shops, operated part-time during present partial mobilization program. Services would finance, at least in part, maintenance and modernization of this tool reserve.

• • •

What's been delaying Vance committee has been military's reluctance to come up with an estimate of its end-item requirements for war. Vance committee can't make up realistic list of tools without such an estimate.

• • •

Fowler is aiming at partial readiness of the economy for war. We can't foresee all requirements for tools, other equipment and raw materials, but we can come a lot closer than we will with the present expansion program.

But it would take another year of controls to do it. Unofficial estimates of the costs run from $1 billion to $10 billion a year of federal funds alone for the next three to five years. And considerable private investment is contemplated in addition.

Price-wage controls would be needed, on a standby basis at least, to curb inflationary pressures of combined arms and tooling-up programs. And some materials allocations would be needed to get work started on some new plant.

• • •

Congress will get its first whack at the tooling-up proposal when it votes on military budget next spring. It may let both price-wage and materials controls lapse before it winds up work on defense appropriations, however.

Present arms buildup is in hand, anyhow. Weapons deliveries will hit peak next year and level off for next 18 months or so. Spending for arms already hit a plateau. When last heard from, Congress was in no mood to go farther.

• • •

Feud over military aircraft between Navy and Air Force, on one side, and Defense Production Administration, on the other, has gone underground. Both sides claim victory. Services say DPA (Campbell) report, which charged there was waste and inefficiency in plane procurement, has been junked. DPA says some recommended changes in procurement already have been made, others will follow. Services are drawing up a new plane-production schedule—A-19—which may tell true story.

• • •

Union members are paying more attention to what their employers tell them and are making up their own minds. Union leaders are trying to figure out what it means.

At Douglas Aircraft, the machinist's union struck one plant, only to have members at another plant accept the management offer.

At General Electric, 21,000 members of the CIO Electrical workers at Lynn, Mass, left the union holding the bag by accepting GE's wage offer just before a strike vote.

• • •

Management and labor leaders may get closer together after the elections. Efforts will be made to get labor-management agreement on labor-law changes. Eisenhower will call a labor-management conference if elected.

David L. Cole, new head of the federal mediation service, is trying to get agreement on steps to keep so many big labor disputes from reaching the White House. He will meet privately with management and labor leaders.

Lowest Cost Way TO DE-BURIZE up to 300 Gear Teeth per minute

Cut finished gear costs and raise output at the same time—with Sheffield #380 Series Gear Deburizers which offer the following advantages.

★ Burr or chamfer spur, helical, hypoid, bevel and herringbone gears, also, multiple start worms, up to 7" O.D. (Model #381 will handle gears from 6" to 12" O.D.)

★ Operate on automatic or continuous cycle generally without clamping the work gear.

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★ Interchangeability of tooling with minimum down time.

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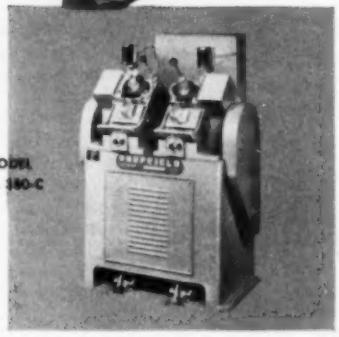
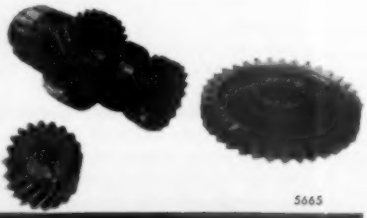


MODEL NO. 380-C



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SHEFFIELD

the Sheffield corporation

Detroit

Production kept boiling along this month at the auto plants. Volume stayed over 140,000 trucks and cars from US and Canada into October.

Many companies had large quota carryovers as the fourth quarter started; schedules ahead will result in the best fourth quarter on record except for 1950.

The first quarter in '53 will be hurt by quota cutbacks, probably, but Detroit is optimistic anyhow. The forecasters figure there is enough steel in sight to keep volume running well.

• • •

While manufacturing activity goes up, so does employment. Manpower shortages here are more and more commonplace. Some plants are hiring women for jobs confined to men heretofore. Things aren't critical yet, but if manpower tightens further, schedules may be back.

• • •

You can figure on some sports-car production, starting with 1953 models. Buick has already announced one, and Cadillac and Olds will do so, too. Packard plans production on its Pan American, and Lincoln has a sportster in mind.

Kaiser-Frazer has the same idea in the low-priced field, using the Henry J chassis. The K-F entry will be distinguished on one count—a plastic body. It will be made of fibrous glass, laminated with polyester resin by Glasspar, Inc, a West Coast company. It's expected to sell at $2300.

Only around a thousand will be made; this limit is set by body-production facilities and methods, which can't handle mass-production yet.

• • •

Another large-scale engineering laboratory has joined the growing group in the industry. International Harvester has opened its new center, an $8-million project for truck engines at Fort Wayne, Ind.

IH is hard at work there, developing along the two current key lines—V-8 engines and automatic transmissions.

• • •

Engines are getting attention everywhere. A V-6 is being put together by a supplier laboratory with the active backing of one of the auto companies. There are other moves of equal interest elsewhere.

The same can be said for power transmissions. In Detroit's outskirts, for example, some intriguing work is being done on magnetic clutches in the small sizes. If the work can be enlarged to auto size, it may spell a new step beyond the field of fluid couplings and torque converters.

• • •

Automotive forge plants are interested in the reports from the new press-forge operation Dodge has in Detroit. Chevrolet is reportedly planning a similar installation at Tonawanda, NY.

The labor pot is boiling hotter. Two separate moves are giving shops the jitters:

1. **UAW-CIO has called for raises** in the "big three" companies, regardless of the contracts that stay closed until mid-1953. The union wants an added 1¢ in the annual improvement factor, which is now 4¢ a year. They want higher pension payments, and they want 21¢ of their present 26¢ cost-of-living bonus moved into the permanent rate.
2. **UAW also wants to stratify workers** into specific job classifications, and to eliminate employment of men who don't have union cards.

• • •

If any of the big three gives way on wages, it is expected everyone else will have to follow suit.

The job freezing is of more concern to the shops. The union wouldn't allow grinder operators, for example, to be moved to the mills—even if the mills are overloaded and grinder hands are idle. Reason? UAW says skilled workers should be classified by machine. Vinco Corp has had a strike on this issue; Heidrich Tool has given up a good-size military contract for this reason.

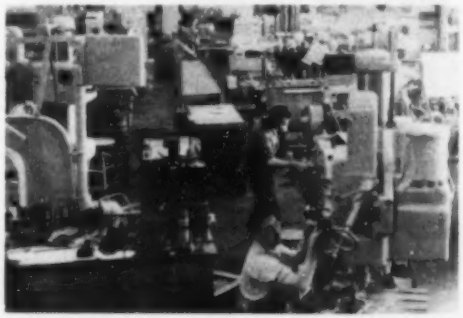
• • •

Apprentices won't consent to machine assignment for fear they'll be frozen into that classification. Graduating apprentices don't help, for they insist on bench work from the start.

Nor will hiring help any. Several companies have hired men off the street, without the journeyman's card. Oddly enough, such hires usually find they don't like their surroundings.

UAW has a solution. The union proposes a "changeover" clause. Under it, the companies would be free to transfer anyone they chose from one machine to another (contractually they can do so now) if they first exhaust the union's list.

The tool and die association turned that one down. The reason: If they accepted, they'd have to hire anyone the union brought forward.



INTERNATIONAL HARVESTER'S EXPERIMENTAL ENGINEERING SHOP at Ft Wayne includes machining and sheet-metal equipment. Test engines and bodies will be built

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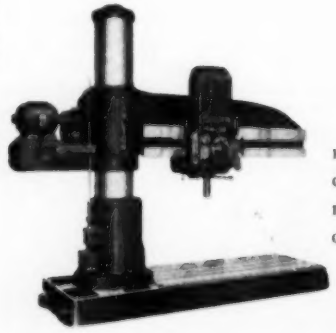

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THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

Machine Tools

Production of machine tools is still on the upgrade, regardless of the steel strike and its effects. Actually, production rate just barely nudged upward in July, whereas it probably has jumped 20 points without the strike to hold it back.

Preliminary August orders are down, but they are still well ahead of those in April and May. Figure for last two years show order drop along in summer, so trend is not dangerous as yet.

• • •

Shipments are climbing back to the June-July level, which was high. Demonstrated production rate is still rising, so shipments will continue high for a good time.

• • •

Revision of M-41, order that restricts exports to rated orders only, will help balance out machine-tool sales as result of Hanover and Olympia shows, although total effect of the exhibitions won't be felt for a couple of months or more.

Improved quality of foreign machines, especially French and Italian, will make exports more difficult in future unless government action on exports is fast and effective. Both foreign machine-tool shows demonstrated that builders in Europe can produce good machines.

Best US export bailiwick is high-production, specialized machines and equipment that is more complex than simple lathes and millers. But foreign concentration on electronics, high spindle speeds, and some advanced designs indicates that US builders will have to work for export business.

• • •

On Hanover and Olympia: Both showed plenty of machines, although Hanover was much larger and more impressive. Hanover beat the tool show in Chicago in size, too. British rule on letting only sales representatives of Continental builders show resulted in large percentage of British machines, but did not exclude all foreign models, by any means.

Ralph S Howe of NPA, at the American Machine Tool Distributors Association meeting in Detroit, reported on progress in meeting national-defense program:

Ralph S Howe

• • •

Builders have increased shipments to rate of over $1.2 billion a year. Used machines, some $60 million worth of them, have been placed in defense plants. Total taken from government stockpiles is about 10,000 units so far; many of these the critical big machines that take a long time to produce.

Some machine transferring—from one defense user who doesn't need them too badly, to another who does—has been done, and a number of tools have been obtained from schools and put to work.

Swan E Bergstrom of NMTBA, at the same meeting, estimated that 90% of the machine tools now in place are equivalent to 10 years old or older (because of design obsolescence or heavy wear because of multi-shift operation), which indicates plenty of replacement potential if quick amortization is allowed.

About 30,000 government-owned machine tools are on hand, ready for lease to military and defense-supporting contractors. NPA's Production Equipment Central Inventory Group, which is responsible for the storage centers at Marietta, Ga, and Omaha, Neb (Air Force machine tools); those at S. Charleston, W Va, Mechanicsburg, Pa, Clearfield, Utah, and Scotia, N Y (Navy); and those of Army and Maritime Commission, lists general-purpose tools as most popular.

Machine-tool pools also have on hand more specialized machines, such as diesinkers, gear cutters, and boring machines.

• • •

Half of new plant and facilities to be aided by fast tax writeoffs will be completed by year end. Civilian industry is just about able to handle its requirements now.

Therefore, appreciable step-up in military production is probably in the offing. By the time all the tax-aided capacity is installed, productive capacity will be considerably up. A change in defense level and goals is likely.

LATEST MACHINE-TOOL DATA; STILL CLIMBING

DATE	ORDERS DOMESTIC	ORDERS FOREIGN	SHIPMENTS	PRODUCTION RATE
July '51	490.6	54.9	144.7	183.2
Aug	488.9	58.7	178.9	192.4
Sept	380.2	27.0	189.8	190.8
Oct	403.9	41.1	221.3	206.7
Nov	330.5	29.0	226.0	225.6
Dec	376.5	18.3	264.7	247.7
Jan '52	347.5	33.6	266.6	259.0
Feb	318.8	14.4	279.6	277.1
Mar	324.3	23.3	299.5	292.3
Apr	293.5	15.6	307.9	304.4
May	284.6	31.4	323.0	321.6
June	342.9	20.3	330.8	342.6
July	374.6	14.9	257.2	346.3
Aug	p311.7	p23.0	p316.0	p351.5

Note: Average figures for 1945-46-47 = 100.
p indicates preliminary figure.

The cutting edges of a DYMON-IZE* ground broach look like this, when enlarged 50 times.

Minute jagged edges are characteristic of conventionally ground broaches (same enlargement).

Specify DYMON-IZE* ground broaches and get

LONGER BROACH LIFE & SMOOTHER SURFACE FINISH

The smoother cutting edges and tooth rakes of DYMON-IZE* ground broaches mean longer broach life, smoother chip flow, and smoother surface finish on broached parts.

All Colonial internal broaches are now available DYMON-IZE* ground at no extra cost.

Specify "DYMON-IZE Ground" on your prints.

PIONEERS OF H.S.S. BROACHING
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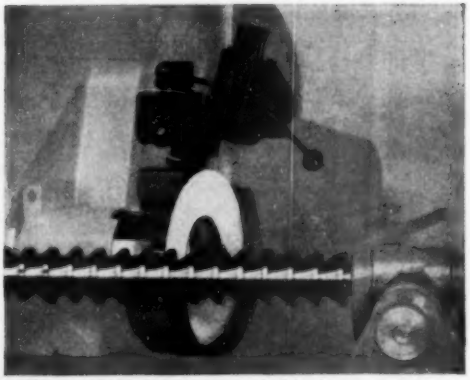

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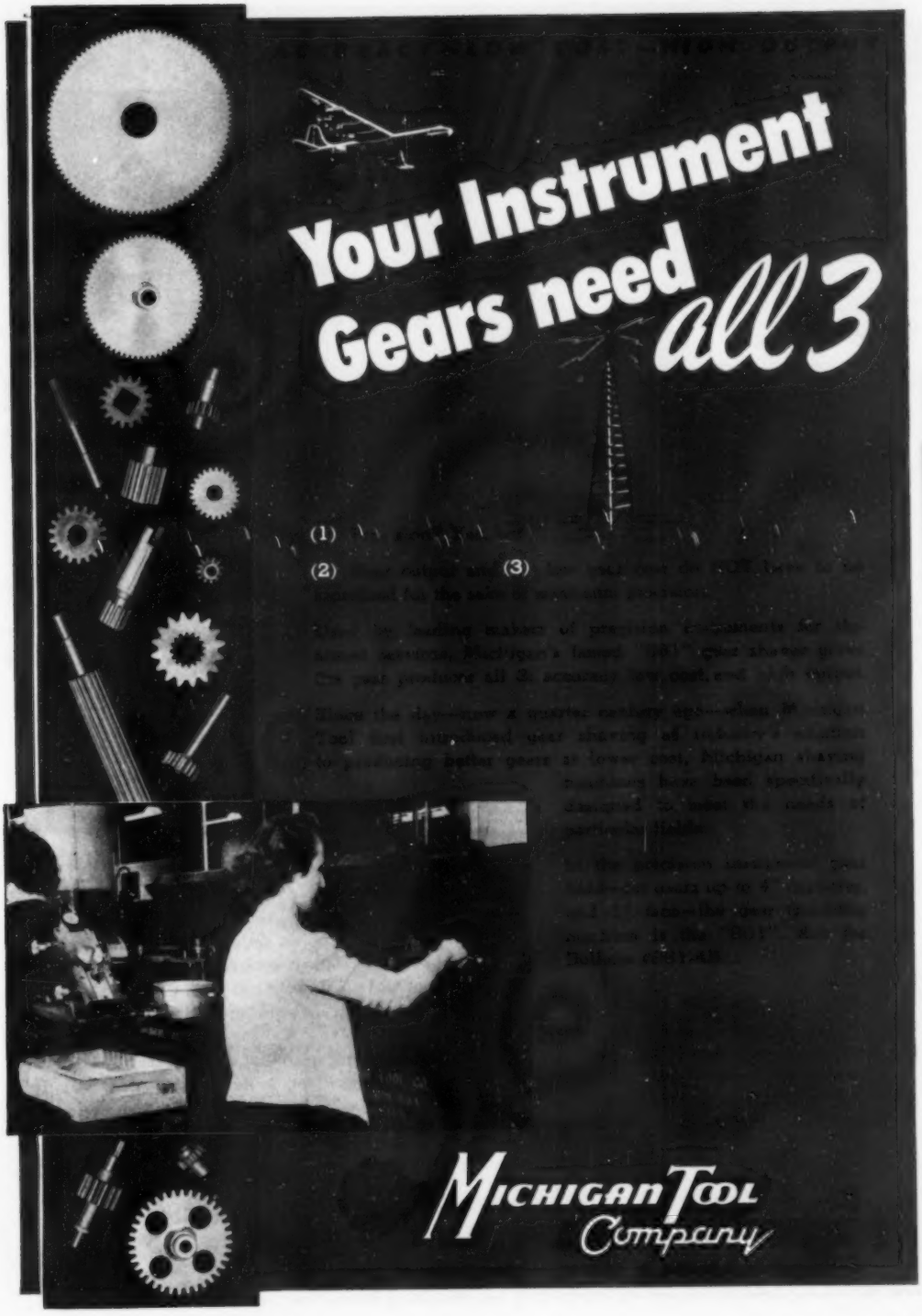
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Gears need all 3
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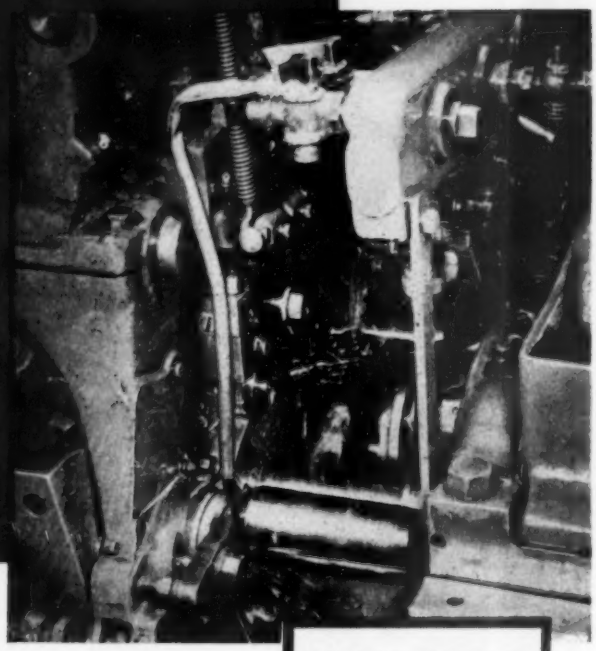

Job: Machining plunger pins for M48A3 fuse
Machine: Davenport Automatic
Metal: #416 stainless steel
Coolant: Texaco Cleartex Oil AX

...when manufacturer changes to TEXACO CLEARTEX OIL

Buchmann Spark Wheel Co., manufacturer of screw machine parts, Long Island City, N. Y., wasn't satisfied with the way a competitive cutting oil was performing on this job of machining stainless steel. Tool life was short, finish not all it should be. So they called in a Texaco Lubrication Engineer who recommended *Texaco Cleartex Oil.*

Improvement was noted immediately. Finish was much superior and tool life was increased some 20%.

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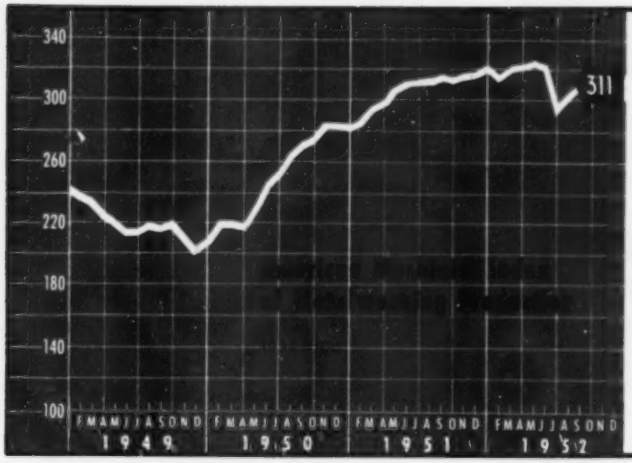
TUNE IN: Tuesday nights on television—the TEXACO STAR THEATER starring MILTON BERLE. See newspaper for time and station.

Gaging Metalworking



INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. '52(*)	AUG. '52(p)	JULY '52(r)	AUG. '51
	311	301	293	311
Total Index	311	301	293	311
Machinery	293	296	296	304
Electrical Machinery	348	332	332	351
Autos	182	162	162	226
Other Transportation	543	538	538	454
Other Metalworking	295	287	287	313

(*)Estimated (p)preliminary (r)revised

Production peak in the spring will be a long one; both military and civilian production are still building up, and will stay up well into next year. Drop off, if any in '53, will be easy.

• • •

Appliances are being produced at a high rate; as much as 25% increase is still looked for. Dealers were buying cautiously, but holiday rush is on and orders are backing up.

Some RR freight-car shops are starting work hoping for new orders by the time they have overcome two-month lead time and short present backlogs.

• • •

Tool and die shops are working under three-month backlogs; much higher than before Korea. July orders and shipments were down 6%, but total orders were considerably ahead of first-quarter level.

Busiest shops are in auto areas, where new models are about to get started. West Coast tool-and-die shops figure on no more expansion, but working level is going up anyhow. Only recent slack there was in smallest shops.

• • •

Aircraft-engine production is still lagging behind airframes, about like a year ago. Stretchout slowed everyone in the industry for a while in the summer, but activity is definitely up now.

• • •

NPA intends to process second-quarter CMP applications, although controls will only linger until June 30. Metal supplies are expected to be adequate. Latest steel week racked up a 104%-of-capacity record.

First-quarter steel allotments to non-defense industry total 60% of the third quarter. NPA expects unfilled third- and fourth-quarter orders to take care of any production lag.

First-quarter copper allotments were as high as the previous quarter, October refined-copper allocations were between third-quarter and last-year levels.

• • •

Aluminum expansion announced by DPA is intended to encourage companies other than the big three, although only two new outfits are now showing interest. Chances are Canada will supply the largest part of the increased capacity wanted.

• • •

Survey of machine shops shows two different work patterns. Plants with a healthy ratio of commercial orders along with defense have recently added sizable non-defense orders, not much increase in defense work. All-defense shops are booming, though.

• • •

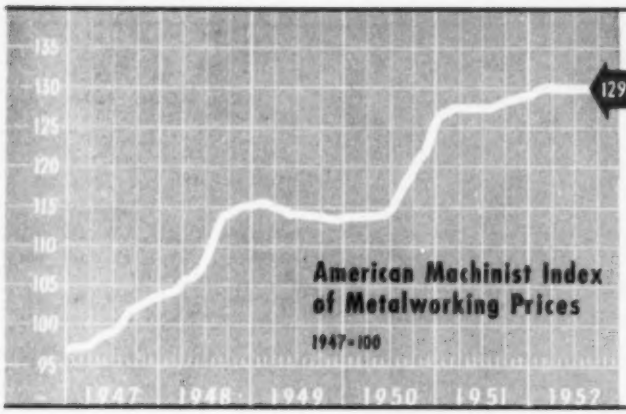
WSB will probably not allow all employers to give annual 4¢ raises for productivity by means of a blanket rule. Cases will be handled individually.

Unions are demanding that employers let pensioners get the $5-8 increase in social security voted by Congress. Some employers have gained where they pay a flat pension, including ss. Unions may try to get Congress to change laws so employer pension share can't be reduced if ss rises.

• • •

Canada is handing her defense plants a new deal—less capital assistance (government has been buying equipment, letting plants use it), but more accelerated depreciation.

Gaging Business



PRICE INDEX

	SEPT. '52(*)	AUG. '52(p)	JULY '52(r)	AUG. '51
	129.5	**129.4**	**129.4**	**127.8**
Metalworking Machinery	137.8	137.8	137.8	133.5
Other Machinery exc. Electrical	132.2	132.2	132.2	132.1
Electrical Machinery	123.9	123.9	123.9	127.1
Fabricated Metal Products	127.8	127.8	127.8	124.8

(*)Estimated (p)preliminary (r)revised

September's industrial production hit 223, a new post-war peak (1935-1939 = 100), and October will beat that mark. For the next six to nine months, at least, production and sales will continue to rise.

Basic industries will have reserve capacity to handle a big increase in demand by the end of 1953, if war should come. Expansion now is going along well enough to meet both present military and civilian needs.

• • •

Big squeeze on profits is illustrated by trends since June '51. Manufacturing wages have jumped 4% since then, while industrial prices have dropped 3%. Profit margin on sales has been chopped one fourth.

Higher output next year will help profits some. Larger volume will counteract effects of lag of prices behind wages. Rising defense spending, high-level business investment, and reviving consumer demand are in prospect.

Coal settlement will result in more mechanization in that industry. Many high-cost operators will be forced out of business, too. Effects on other industries will be slight.

Best estimates for national-security spending in the next nine months, counting defense department, atomic energy, and foreign aid, are these:

Last quarter of this year will show increase in spending over third quarter. Steel strike delayed deliveries, which will hump the last quarter. Third quarter—$12¾ billion. Fourth quarter—$13½ billion.

Spending in first quarter of '53 will be around $13¾ billion and will jump a quarter billion in the second quarter.

• • •

Manufacturing employment jumped 700,000 from July to August. Soft goods (leather, textiles) are doing better, too.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	249.4	248.5	231.5
Steel ingot operations (thousands of tons)	2,153	2,160	2,051
Electric power output (million Kilowatt hours)	7,625	7,725	7,102
Production of automobiles and trucks	142,893	147,748	113,973
Engineering construction awards (*Eng. News-Record*, millions)	$234	$317	$422

QUARTERLY BUSINESS INDICATORS

	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	$343.2	$339.4	$337.1
Expenditures of new plant and equipment (millions)	6,951.0	6,228.0	6,665.0
Profits after taxes—manufacturing (200 corporations) (millions)	756.0	932.0	877.0
Profits after taxes—durable goods (106 corporations) (millions)	445.0	565.0	510.0
Profits after taxes—primary metals and products (39 corporations) (millions)	162.0	217.0	188.0
Profits after taxes—machinery (27 corporations) (millions)	81.0	123.0	90.0
Profits after taxes—autos and equipment (15 corporations) (millions)	170.0	185.0	194.0
Motors and generators new order index (1936 = 100)	517.0	573.0	780.0

* Seasonally adjusted

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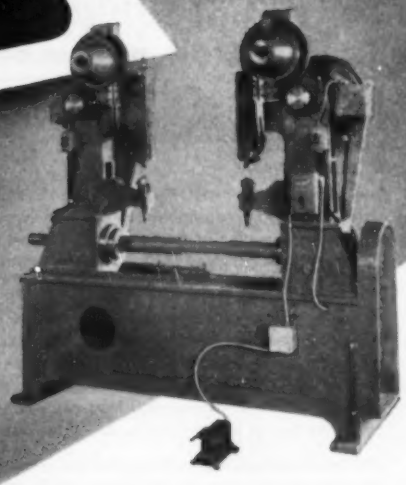
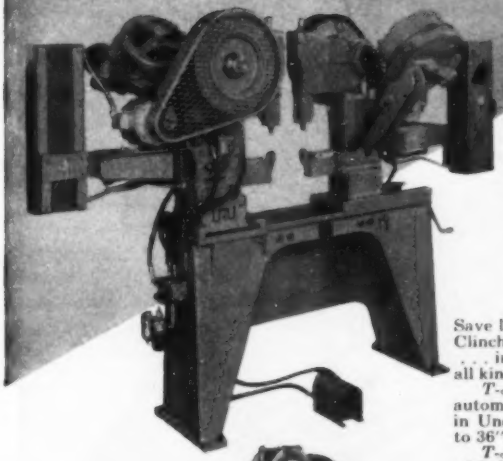
T-J DOUBLE RIVITORS AND CLINCHORS!



RIVITORS

Set two rivets at a time with this new T-J Dual Rivitor! This machine is equipped with 10" hoppers, and tooled to automatically feed and set two ¼" dia. x ⅝" long wagon box head rivets at a time in elevator chain and saddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.



CLINCHORS

Set two nuts at once with the new T-J Double Clinchor! This machine is tooled to feed and set ⅜" x ½" x $\frac{1}{16}$" thick Fabri-Steel nuts at each operation. Both Clinchors are tripped by the same foot-operated valve. Adaptable to a wide range of clinch nut setting problems.

Save labor . . . speed up production with T-J Rivitors and Clinchors adaptable to a wide range of assembly jobs today . . . in aircraft, automotive, farm machinery, stampings of all kinds.

T-J Clinchors set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J Rivitors automatically feed and set solid rivets . . . with high production! Electrically-powered Rivitor sets $\frac{1}{16}$" to $\frac{1}{4}$" diam. solid steel rivets up to $\frac{7}{8}$" long. Air-powered Rivitor sets aluminum alloy rivets up to $\frac{1}{4}$" diam. or steel rivets up to $\frac{1}{8}$" diam. and up to $\frac{3}{4}$" long. Throat depths 8" to 36".

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Company, Jackson, Mich.

T-J Riviter used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.

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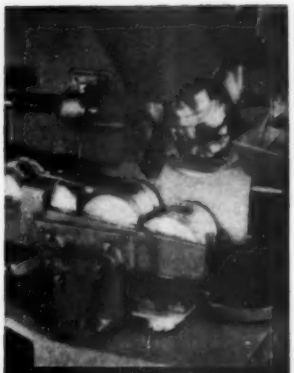

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pistons balanced automatically

For the first time, this MORRIS Mor-Speed Production Machine makes piston balancing 100% automatic. Parts are unloaded automatically from a standard conveyor, processed or rejected and returned to the conveyor "untouched by human hands."

Underweight or grossly overweight pistons are automatically rejected without interrupting the production flow. Depending on a cycle time ranging from 5 to 8 seconds per part, production is 450 to 720 parts per hour varying with the amount of metal to be removed from each piece at 80% efficiency and to a plus-or-minus one gram accuracy limit!

MORRIS Automatic Piston Balancing Machines are used by a number of the major automotive producers. If you have a piston production line, let Morris Engineers show you case history proof of time, labor, money and floor space savings.

Write today for NEW bulletin describing and illustrating the revolutionary MORRIS Piston Balancing Machine.

The Morris Automatic Piston Balancing Machine takes only 27.3 square feet of floor space to turn out up to 12 accurately balanced pistons every minute!

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

On European Competition

LONDON, England — The problem of cutting costs is foremost in the minds of an increasing number of European metalworking manuacturers. That fact has been driven home to me after only two weeks in England and in Germany.

Europeans, by necessity, are more export-minded than Americans. They are compelled to sell a large proportion of their production abroad in order to live. Thus they are anxiously surveying the prospects ahead for sales in world markets.

They know that unless a sudden and unexpected war crisis should arise, manufacture of armament will absorb only a modest ratio of their hoped-for output the next few years. They must look to civilian demand for future prosperity.

THE COMPETITION will be rough. Western Europe, and particularly the metalworking industry, has staged an amazing recovery, thanks in large measure to Marshall Plan financing. There are spacious plant facilities to be kept busy with orders.

At the same time, the elements which make up production expense show no signs of moving downward. They are more likely to go up. And as time goes on, mere ability to make early deliveries will fade as a sound reason for placing business with one company rather than another.

Yet price is bound to loom more importantly month by month as a persuasive sales argument. It already is being talked about by many customers who are hoping to press harder for price advantages.

That being the situation, it is easy to understand why more and more metalworking people over here are thinking in terms of cutting costs. They realize that they must do so if earnings are not to shrink substantially.

CUTTING COSTS means to them getting more production per worker. One manufacturer told me that he wants to replace old equipment in his plant as rapidly as possible with new machines. When and if he is able to carry through his program, he will be able to produce with 800 men the same physical output of goods that he now gets out with 1300 men. He expects his costs to go down sharply as a result.

This sort of thinking is taking hold all over Europe. To be sure, plenty of old-timers still cling to the outworn theory that it is cheaper to employ low-wage workers than to invest in machines. But this stodgy group is losing followers from its ranks almost daily.

Modernization of plant equipment is in the air. New factories are being erected and filled with machines of the latest design. New processes are being tried. Europeans don't seem to be afraid of innovation.

THE LESSON for us back home is plain. We cannot afford to sit on our laurels and think that we have the advantage over everybody else. The only way in which we can keep our position at home and in world markets is to do what Europe is in the process of doing—preparing by mechanization for the competitive struggle ahead. The time to prepare is now.

Burnham Finney

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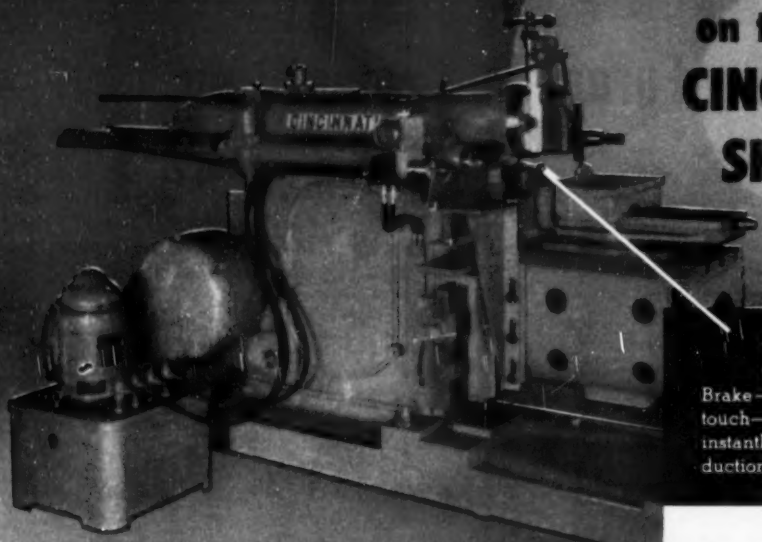
on the *same* CINCINNATI SHAPER



The powerful Cincinnati Magnetic Clutch and Brake—controlled with a finger touch—starts and stops the ram instantly, and speeds production.

YOU can change from Standard Shaping to Automatic Duplicating without a hitch on this hydraulic follower-equipped Cincinnati Shaper. The duplicating mechanism does not interfere with standard shaping operations.

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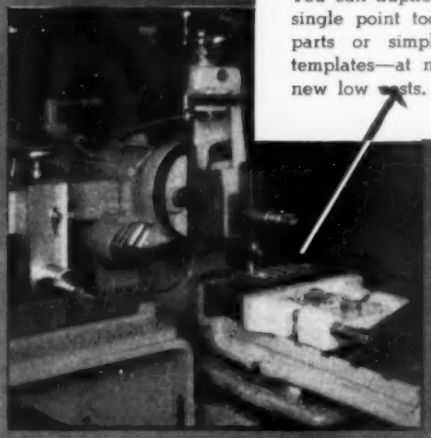
Write for Automatic Contour Duplicating Bulletin DN-1 and Catalog N-5.



You can duplicate parts with a single point tool, using actual parts or simple sheet metal templates—at new speeds and new low costs.

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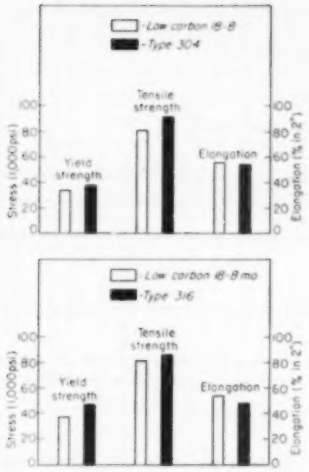

FIG. 1 .. Low-carbon stainless steels have greater elongation than their higher-carbon counterparts but yield and tensile strengths are not as high

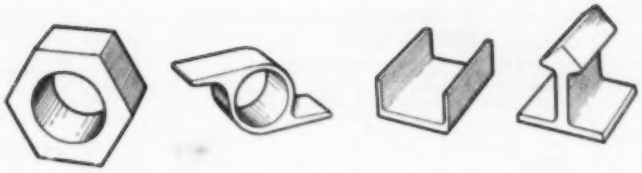

FIG. 2 .. Hot-extruded bar shapes can be made of carbon, alloy or stainless steel by the Ugine-Sejournet process

Why We Now Make Better Stainless Steels

Selection and heat-treatment of stainless steels have been simplified by advances in steel melting practices and improved knowledge of heat treatment. Further improvements in heat- and corrosion-resistant steels can be expected

By J J HEGER, Research Associate, Research & Development Dept, U S STEEL CORPORATION

About 1900 years ago, Pliny[1] described a chain that had been stretched across the Euphrates by Alexander the Great. This chain, which was about 300 years old in Pliny's time, required several repairs, among which was the installation of new links. Pliny observed that these new links were not lasting as long as the original ones and implied that the iron produced during his era was not as good as the iron produced by previous generations. This implication of Pliny's has echoed down through the ages. Even today, the remark is made that the steels produced today are not as good as those produced several decades ago.

To those who are associated with research and development, a remark such as this is of some annoyance, particularly because it is based on a casual observation that fails to comprehend all of the facts. Actually, the steels of today are better than those produced 20 years ago, as indeed the steels of 20 years ago were better than those produced 40 years ago, and 1970 steels will be better than today's.

Consider, for example, the stainless steels. Since 1930, remarkable achievements have been made. The problem of intergranular corrosion has been solved, the dimensional and surface quality of the stainless steels has improved, and new alloys have been developed.

The achievements that have resulted cannot be credited to the steel producers alone. The steel-consuming industries have played a significant part in attainment of these achievements. Primarily, steel is made to be used. Thus, the needs of the consumer form the basis for much of the steel producer's research and development.

Stabilized Stainless Steels

One of the early primary needs was for an austenitic stainless steel that, when welded or stress-relieved, would not be susceptible to intergranular corrosion. This need was satisfied by development of the stabilized grades of stainless steel: Type 321, which is the 18-8 Ti, and Type 347, which is the 18-8 Cb grade. At the same time, maximum carbon content of the plain 18-8 grade was lowered from about 0.15% to 0.08%. Although this reduction of carbon content was beneficial, still lower carbon contents were needed for satisfactory resistance to intergranular corrosion. Unfortunately, however, for some years these low-carbon stainless steels could not be melted consistently. Today, as a result of continuing developments and improvements in the technology of melting, the 0.03% maximum carbon steels are made consistently.

Properties of low-carbon stainless steels, that is, those below 0.03% carbon, are good. As will be noted, from Table 1[2], these steels exhibit resistance to intergranular corrosion when welded. As might be expected, the strength of the low-carbon steels is slightly lower than that of the higher carbon steels. But, as will be noted from Fig. 1[2] the difference between the two is small.

An entirely new method for processing steel is on the threshold of reality. This new method is extrusion.

Although extrusion of the non-

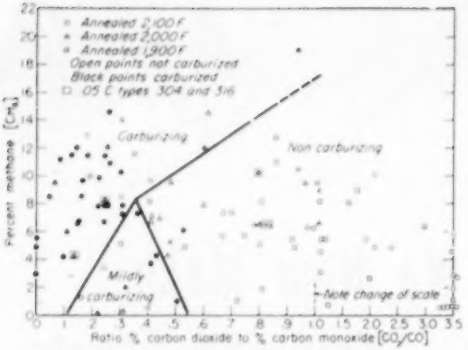

FIG. 3 . . By maintaining the CO_2/CO ratio above 0.55 and methane in suitable range, low-carbon stainless steels can be heat-treated without scaling or causing intergranular corrosion

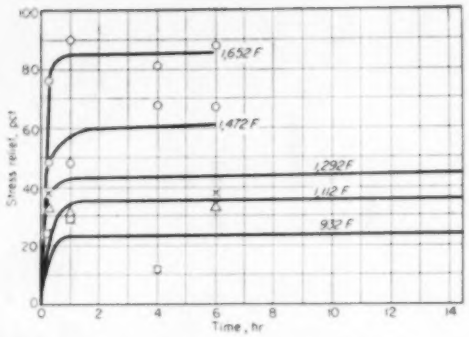

FIG. 4 . . To attain a maximum fiber stress of 33,000 psi (75% of yield strength), it is necessary to stress-relieve at 1650 F for about 1 hr

ferrous metals has been practiced for many years, extrusion of the ferrous metals has been difficult. High hot-working temperatures of the ferrous metals presented obstacles to lubrication, and die life has been short. These problems were solved by the French, [5], [7], who conceived and developed the idea of using glass as a lubricant. At the hot-working temperature of ferrous metals, the glass becomes liquid, acts as a lubricant, and, in addition, insulates the dies from the high temperatures involved, thus prolonging their life. Using this process, the French have successfully extruded tubes, bars, and complicated shapes of carbon, alloy, and stainless steels. Examples of the sections that can be made by the extrusion process are shown in Fig 2.[6]

For Small-Lot Orders

The extrusion process will be useful for the production of small orders, which heretofore required expensive rolling-mill changes. In addition, extrusion will be advantageous for production of bars, shapes and tubes from alloys that heretofore have been considered to be nonrollable, and for the production of shapes that are difficult to roll.

Another problem is that of selecting proper heat treatment. Stainless steels appear to be simple to heat treat, but it must not be forgotten that they are used primarily to resist corrosion. Therefore, the heat treatments given these steels must develop the optimum corrosion resistance of which they are capable.

Of importance, particularly to the stabilized and low-carbon grades of stainless steel, is avoidance of surface carburization during heat treatment. Carburization can be avoided by excess oxygen in the furnace atmosphere. However, excess oxygen produces a heavy scale that may be detrimental to surface finish. Therefore, many furnaces are operated under a so-called reducing atmosphere. Scale is reduced, but, unless furnace operation is controlled, carburization of the steel may occur, particularly in still atmospheres.

To determine atmospheres that will not carburize stainless steels during heat treatment, an investigation was made. The results are summarized graphically in Fig. 3.

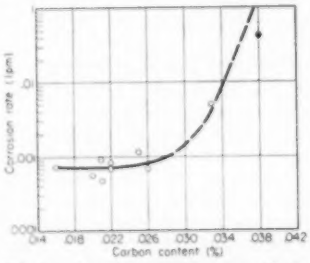

FIG. 5 . . Corrosion rate increases with the carbon content of 18-8 stainless steels heated 2 hr at 1200 F. Reagent: 65% boiling nitric acid

As will be seen, furnace atmospheres having a CO_2/CO ratio of less than 0.55 are carburizing. Furnace atmospheres having a CO_2/CO ratio of over 0.55 are noncarburizing, unless methane exceeds 8%. With higher CO_2/CO ratios, larger amounts of methane can be tolerated. Thus, to avoid carburization during heat treatment, the furnace atmosphere must be adjusted so that the CO_2/CO ratio is above 0.55 and the methane content is kept below the amount shown in Fig. 3.

When to Stress-Relieve

Considerable controversy exists over stress-relieving the austenitic stainless steels. Many producers and consumers claim that stress-relieving of the chromium-nickel types after fabrication and welding is not necessary. They argue that such steels are inherently tough and ductile and that often a stress-relieving treatment will cause more harm than good. These arguments are logical. The stainless steels are inherently tough and ductile and for many applications do *not* require a stress-relieving treatment. It also is true that a stress-relief treatment, particularly one not conducted properly, will do more harm than good. For example, even the 1900 F and water-quench treatment, if given to an article of complicated design, may induce more stresses than it relieves.

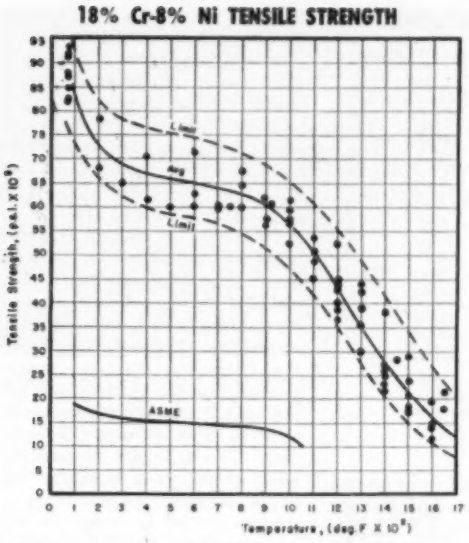

FIG. 6 . . Tensile strength of 18-8, Type 304, at elevated temperatures, and the ASME allowable working stresses derived from these data

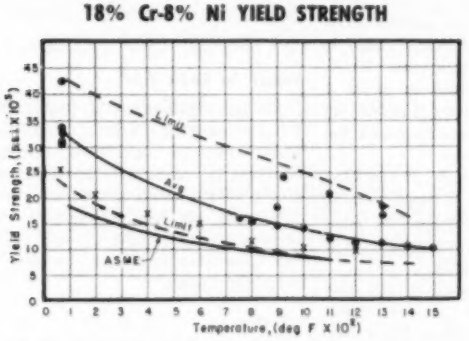

FIG. 7 . . Yield strength of 18-8, Type 304 at elevated temperatures, and the ASME allowable working stresses

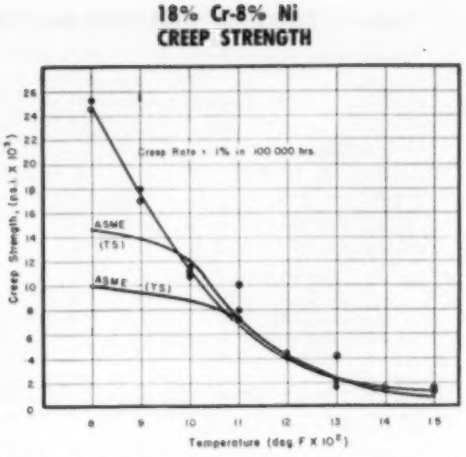

FIG. 8 . . Creep strength of 18-8, Type 304. For comparison, the ASME tensile and yield strength values are plotted

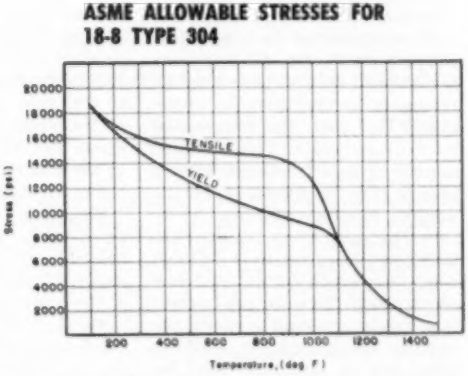

FIG. 9 . . Allowable working stresses for 18-8, Type 304, are summarized by these stress-temperature curves

Although part of the argument against stress-relieving is logical, specifications may require a fabricator to stress-relieve his product. It the product is exposed to an environment that causes stress-corrosion cracking, the product should be stress-relieved. In this case, the fabricator must select a treatment that properly relieves stresses and at the same time does not impair corrosion resistance.

The effect of time temperature on relief of stresses is illustrated in Fig. 4.[4] On this graph, the amount of stress-relief of Type 347 originally stressed 33,000 psi (75% of its yield strength) is plotted vertically, and the time for heating at the indicated temperatures is plotted horizontally. As will be noted, the stress-relieving temperatures must be above 1600 F if over 80% of the original stress is to be removed. Also, time at temperature beyond one hour has little effect.

Although stress-relieving at 1470 F and 1290 F removes over 40% of the original stress; the use of these temperatures on welded articles of Types 321 and 347 stainless may cause susceptibility to a form of intergranular corrosion known as "knife-line corrosion" at the weld metal-parent metal interface. This effect can be prevented by stress-relieving for appropriate times at temperatures of 1600 F or higher. For the stabilized and low-carbon grades, rapid cooling from the stress-relieving temperature is not necessary.

Today, the problem of selection of stainless steels is rendered difficult by scarcity of alloying ele-

Table I — RESULTS OF WELD TESTS ON STAINLESS STEELS[2]

U = Unsatisfactory Corrosion Resistance S = Satisfactory Corrosion Resistance

WELD ROD	18-8 TYPE 308 20-10 0.08% CARBON, MAX.	18-8 TYPE 347 18-8 Cb 0.03% CARBON, MAX.	18-8 Cb TYPE 347 18-8 Cb 0.08% CARBON, MAX.	18-8 Cb TYPE 347 18-8 Cb 0.03% CARBON, MAX.	18-8 Mo TYPE 316 18-8 Mo 0.08% CARBON, MAX.	18-8 Mo TYPE 318 18-8 Mo Cb 0.03% CARBON, MAX.
As Welded:						
1-in. gage	U	S	S	S	U	S
½-in. gage	U	S	S	S	S	S
0.078-in gage	U	S	S	S	S	S
As Welded + 1600 F - 2 hr[A]						
1-in. gage (air-cool)	U	S	S	S	U	S
½-in. gage (air-cool)	U	S	S	S	U	S
½-in. gage (slow-cool)	—	S	—	—	—	U

[A] (1) *Cooling time for 1-in. gage, air-cooled, was 8 min. from 1600 F to 600 F.*
(2) *Cooling time for ½-in. gage, air-cooled, was 3½ min. from 1600 F to 600 F.*
(3) *The ½-in. gage, slow-cooled material was heated 300 F per hr to 1400 F, held 2 hr and then cooled 300 F per hr to 600 F.*

ments. For example, columbium is so scarce that the use of the 18-8 Cb grade is limited by government regulation. Fortunately many hardships imposed by scarcity of columbium have been alleviated by development of the low-carbon stainless steels. Fig. 5[2] illustrates the effect of carbon content on the resistance to intergranular corrosion of 18-8 steels that were heated for 2 hr at 1200 F. This so-called sensitizing heat treatment is more severe than encountered during welding or stress-relieving. As illustrated, satisfactory resistance to intergranular corrosion is obtained when the carbon content is below about 0.03%. Thus, in applications that involve welding or stress relieving, the low-carbon stainless steels can be used. The need for 18-8 Cb in these applications is eliminated.

ASME Working Stresses

Often the selection of the proper stainless steel is based upon strength requirements at elevated temperatures. Obviously, the steel selected must be one that during its intended service will not rupture under the applied load. It was on the basis of this axiom that ASME allowable working stresses for unfired pressure vessels were established.

The recent revision of the allowable stresses was based upon all of the data available for each steel considered. To illustrate the improvement in these stresses, the method used by the ASME Boiler Code Sub-Committee to assign stresses to 18-8, Type 304, will be considered. The Committee operated under the rule that the allowable working stress at each temperature shall not be greater than 25% of the tensile strength, 62½% of the yield strength, and 100% of the stress required to cause a creep rate of 1% in 100,000 hr or 100% of the stress required for rupture in 100,000 hr.

Fig. 6 illustrates all of the elevated-temperature, tensile data available for 18-8, Type 304. Also shown are data representing 25% of the tensile strength.

Fig. 7 illustrates all of the elevated-temperature, yield-strength data available for 18-8, Type 304. Also shown are data representing 62½% of the yield strength. The data marked with an *X* represent a steel that had a room-temperature yield strength below 30,000 psi. Because the allowable working stresses apply only to steels having a yield strength of 30,000 psi or over, the committee logically did not consider these data when calculating the allowable working stress based upon 62½% of the yield strength.

Fig. 8 illustrates all of the data for the stress required for a creep rate of 1% in 100,000 hr. For comparison purposes the data representing 25% of the tensile strength and 62½% of the yield strength are shown for temperatures of 200, 900 and 1000 F.

A summary curve giving all of the possible working stresses is shown by Fig. 9. In accordance with the rule given above, the allowable working stress is governed by the yield strength up to 1050 F and by the creep strength at higher temperatures.

The ASME Committee recognized that the inherently low yield strength of 18-8 resulted in this material being assigned stresses much lower than those assigned to several of the low-alloy steels. The Committee therefore recommended that for temperatures below 1050 F, two sets of stresses be assigned. One set would be based upon the tensile strength and the other on the yield strength. The choice between the two sets of stresses would be made by the consumer, who would be advised that the use of the higher stresses might result in a certain amount of plastic flow during service. If plastic flow cannot be tolerated, use the lower set of stresses.

What to Look For

Future developments that will be forthcoming include stainless steels having maximum carbon contents less than 0.03%, titanium steels of improved cleanliness, information on the mechanism of stress-corrosion cracking, and new and improved heat- and corrosion-resistant alloys.

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[4] "Stress Relief of Stainless 347 Investigated". H Sotf, **Iron Age**, Sept 28, 1950, pp. 78-80.

[5] "The Strength of Wrought Steel at Elevated Temperatures," R F Miller and J J Heger. ASTM Special Technical Publication No. 100.

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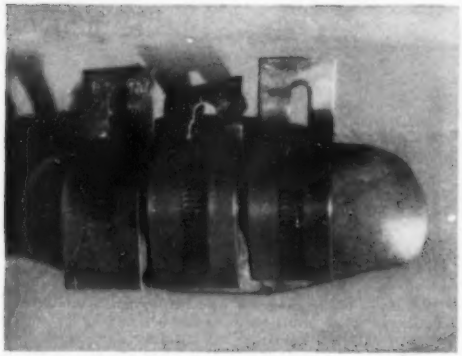
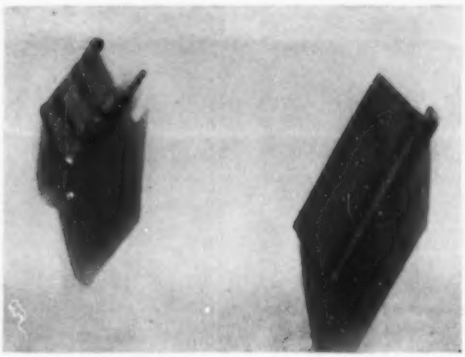


COMPARATIVE BEND ANGLES of RC-130A (left), Ti 75A (center), and 302 stainless (right). All were bent 90° but the titanium sprang back and the RC-130A cracked



COMMERCIALLY PURE 0.025-in. titanium was successfully bent 180° with a bend radius of 2T, but the RC-130 alloy failed after only 45° bending

HOW WE WELD TITANIUM

Here's an important contribution to the literature on titanium welding based on information developed by tests. Included here are not theories, but hard-bitten shop facts, learned the hard way

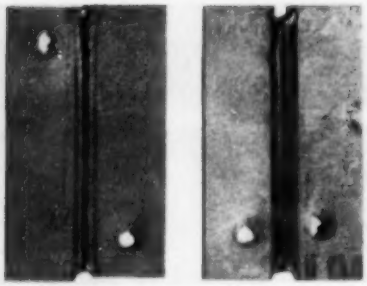
BY THOMAS R BRADLEY, Chief Metallurgist, ROHR AIRCRAFT CORP, Chula Vista, Calif

Types of titanium welding we have attempted to date are resistance and machine heliarc fusion. All of it has been done on 0.020- to 0.062-in. material and only on titanium 75A, Rem Cru 130 and Rem Cru 70. In general, the problems encountered in fusion welding titanium are similar to those of stainless steel, the major difference being the need for tighter controls on all variables. For example, proper mating of the butted edges and the surface preparation are more critical. We are developing control of shearing so the maximum gap between the two sheets when they are butted together does not exceed 8% of the material thickness. The inert atmosphere must give more protection, and the fused zone must be shielded for a longer time than is necessary with stainless.

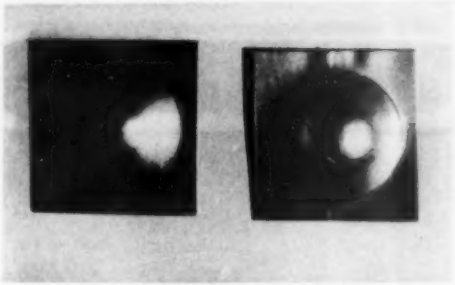
Most of the troubles with titanium have been from a need for slight mechanical adjustments, rather than any major difference in technique. The welding has been performed on several machines. One is Rohr-made and includes a dc, 300-amp-capacity welder which will weld material up to 54 in. long. On this machine, argon, helium, and mixtures of the two have been used. The best welding on this has been obtained with a mixture of the two gases. The other machine uses a dc, 300-amp welder with automatic arc-gap voltage control and requires helium only. It will weld 120 in. of material.

A typical example of the settings used on titanium 75A, 0.025 in. thick: a mixture of 7 liters of helium, 14 liters of argon—7 liters per min on the top and 15 from the back. It was welded at 23 ipm at 20 amp. The backup bar has a V-shaped slot approximately ¼ in. wide at the top. The gas enters through holes 1/16 in. apart at the apex of the slot. This backup bar is the only component of the machine that had to be changed to weld titanium. The original bar did not have as deep or as wide a slot, and shielded the weld in spots only. Our past practice on machine welding has been to control penetration by the speed of travel, and we find it necessary to weld about half as fast when welding titanium as when welding stainless. From the first, we were successful in obtaining a weld bead having excellent appearance, but poor ductility. Those we are now making still have the same appearance, but we now feel that titanium 75 and RC 70 can be welded with improved ductility of the weld and weld area. The RC 130A welds exhibit quite a large amount of brittleness but resistance welds exhibit enough of a bend angle that we consider it weldable for some assemblies. Because embrittlement can not be detected visually, we have had to set up a rather com-

Some portions of this material were delivered by the author as a paper at the recent Titanium Fabrication Conference of the Dept of Defense



TOP AND BOTTOM SIDES of RC-130 weld. Weld is apparently uncontaminated by O. but is nevertheless brittle



CUP TEST shows failure along the weld (left) which is considered unsatisfactory. Failure across the weld (right) is satisfactory

plete testing program, plus closer control of our machine welding.

The problem in the evaluation of quality is to distinguish between a brittle weld and a satisfactory one. At present, we are setting up a machine certification procedure covering every material combination to be used. We are not yet welding a variety of alloys, but we are welding a commercially pure titanium that varies in tensile strength through a wide range. Physical data on each sheet of titanium in stock has been obtained, and each sheet has been stencilled with a Rohr number so material with known tensile properties can be selected for each job. Eventually, the requirements of different welding procedures for different ultimate strengths may be eliminated but, at present, we are watching this closely to get a measure of safety factor in welding.

Laboratory Checks

Before any production parts are joined, two pieces, 11x3 in., from the same sheet as that from which the production part is to be made, are welded and submitted to the laboratory for examination. The laboratory makes tensile tests across the weld, tensile tests on weld metal only, bend tests across the weld and in the same direction as that of welding, if possible, and cup tests. These are all for measuring weld ductility. We are finding that a tensile test on weld metal only will show an elongation of 12 to 16% on the 70 and 75 material. However, this is not a good test for controlling quality as the size of the weld bead affects the results.

Bend tests show a minimum bend radii of 2T on satisfactory welds. The Rem-Cru 130 alloy fails with little or no bending. The appearance of the weld is shiny bright and free of any traces of even occasional superficial purple or other oxide. The failure seems to be due to the large grains and brittle grain boundary constituents. Welds in titanium 75 and RC 70 which have the brightest and cleanest appearance are the ones which show the best ductility. No standards of performance for the cup test have been set; it is used merely to see where and how the weld fractures. The assumption is that, if the failure occurs down the center of the weld bead, the weld is not satisfactory, and if the failure is across the weld bead the weld is satisfactory as far as this test is concerned. Past welding experience shows that 100% perfect welding is never achieved in production, so weld repairs are always expected. The titanium welds seemed at first to resist any repair. Later on, it was possible, in some cases, to repair them satisfactorily by using a heat roughly three times that of the original welding; other welds were repaired by going over them with the same heat. The repair problem is receiving further investigation.

Surface Preparation

At present, several processes for surface preparation are being developed at Rohr. Preparation of the as-received material consists of degreasing in a vapor degreaser and then dipping in a solution of 2% hydrofluoric and 10% nitric acid. The instrument used for measuring surface cleanliness is a micro-ohmmeter. This has been used, with excellent results, to measure the cleanliness of aluminum for spotwelding, for approximately five years. The test consists of clamping two pieces of metal between two spotweld electrodes with a constant pressure and current. The resistance reading is taken by tapping into the ends of the two samples. Typical readings for titanium with different surface preparations are shown in the accompanying table. If we increase the pressure, we decrease the resistance measured. Consequently, to compare different surface preparations, we hold the pressure constant.

In spotwelding, the assumption is that the requirements for good titanium welds should be similar to those of stainless. This has proved to be fairly correct. To date, we have accomplished titanium spotwelding on several machines. These are single-phase, ac machines with 75- and 125-kva ratings. We have

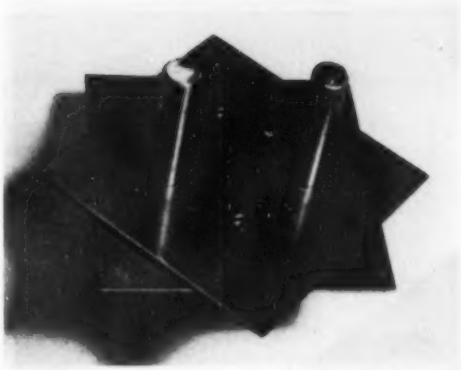
	MICRO-OHM READING		MICRO-OHM READING
As received - degrease	1100	Annealed	9200
" " - steel wool	120	"	8000
" " - sand blast	180	" - sand blast	175
" " - chemically cleaned	90	" - chem cleaned	30

MICRO-OHM READINGS furnish a measure of the degree of cleanliness of titanium after different cleaning methods

also accomplished welding on the condenser-discharge-type machine which gives us a better consistency than does the ac machine. However, we are handicapped with the ac machine because of variations in plant line voltage. The first welds made seemed to indicate that 100% penetration was needed to secure a satisfactory shear strength, but we discovered that the penetration measurements were incorrect. The titanium spotweld nugget differs only slightly in appearance from that of the heat-affected material adjacent to it. Consequently, the heat-affected area was being measured, rather than the nugget size. A suitable etchant has not yet been developed for the shop to use for this purpose. In the laboratory, the nugget is located by etching, repolishing, and etching the sample. This is impracticable in the shop.

The shear values now being obtained are approximately the same as those obtained on ¼H stainless. We feel that, as in stainless, control of penetration and shear is sufficient to insure an acceptable weld quality. We have attempted to make tension tests on titanium spotwelds but all we have been able to prove is that differences in methods of testing produce variations in results. The problems of tension testing have been discussed with others in the industry and there is a wide difference of opinion as to how the test should be made and how to interpret the results. One company has devised a test which we feel will give the closest approximation to a pure tension value of any yet seen. However, none of the tests devised gives pure shear or tension results.

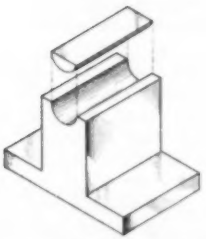
The tension test consists of machining four holes, 90° apart, in two square sheets, and four smaller holes at an angle of 45° from the other holes. These are also precision drilled into the sheets. The sheets are turned 45° to one another and spotted together. Then the spot is pushed apart by means of four



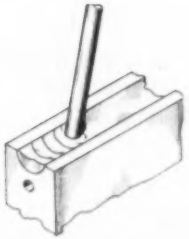
TENSION TEST for spotweld with two of the four pins in position. Setup is designed to prevent bending as tension is increased

plugs passing through the larger holes from each side of the sheet. These plugs have a pilot which passes through the smaller hole on the opposite side. The purpose of this is to attempt to prevent bending as the tension progresses. From the results of these tests, it has been found that the tension-shear ratio for a titanium spotweld is lower than that of a stainless-steel weld. Also, the tension-shear ratio seems to go down as the tensile values of the parent metal go up. This information may be useful in design but it is no measure of the quality of the spotwelding process. There are some who would attempt to measure the quality of production spotwelding by use of tension testing. We do not believe we can get a satisfactory tension test in the shop and, as we are controlling the tensile strength of the material we use for each part, we do not feel it would give us any useful information even if the test were accurate.

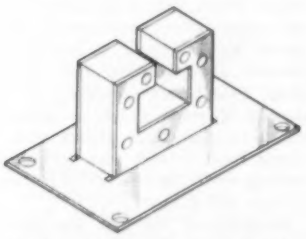
WELDING SPEEDS SOLENOID PRODUCTION



CONVENTIONAL METHOD of applying hard face to solenoid anvils is by silver-brazing a hardened steel (55 to 60 R_c) insert into a machined groove in the face. Production is about 100 anvils per operator per day



NEW METHOD is to clamp anvils end to end and deposit a 5% chromium tool-steel bead with Lincoln Toolweld shielded-arc electrode. 55 pieces are faced with 1 lb of electrode, and one operator can produce 1000 a day



SOLENOID LAMINATIONS are also welded to sheet-steel bases with mild steel electrodes, instead of silver brazed. Two minor changes were required in the stamping dies, but production was tripled

Re-set Pawl Tolerance Held by Powder Metallurgy

Critical dimension on a tiny business-machine part checked by National Cash shows one advantage to special processing — closer tolerance. Another is faster production

Counter re-set pawls for business machines have been made both by powder metallurgy and stamping, shaving, and tumbling by The National Cash Register Co. These parts are tiny and tolerances are rather close. One dimension — from the hole center to the face of a tooth — is particularly critical, and was specified as plus or minus 0.002 in. Originally made by blanking, parts are now made by powder metallurgy. This provided an opportunity for a comparison on maintenance of tolerances.

Powdered-metal parts were checked once after pressing in a Stokes press, once after sintering, and again after carburizing and hardening. Stamped parts were checked after shaving and tumbling. Results were charted on a Quality-Quantity graph on which the horizontal scale shows variations from correct size, and the vertical scale the number of pieces in each size group.

Readings of the first five altitudes of Graph 1 showed powdered metal parts, as "green" briquettes, to be:

3 pieces 0.0002 in. over zero tolerance

4 pieces 0.0001 in. over zero tolerance

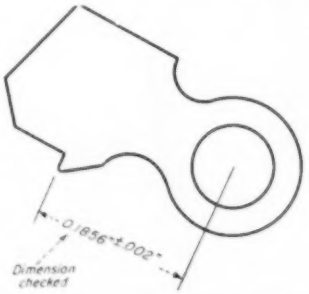
8 pieces exact size

7 pieces 0.0001 in. under zero tolerance

13 pieces 0.0002 in. under zero tolerance

Calculation for the 200 pieces gives an average deviation of 0.00057 in. from the mean blueprint tolerance, and a median deviation of 0.0005 in.

Graph 2 shows the deviation of the same pieces after sintering, which, as might be expected, shrinks them slightly. Here the average deviation is 0.00095 in. and the median 0.0009 in.



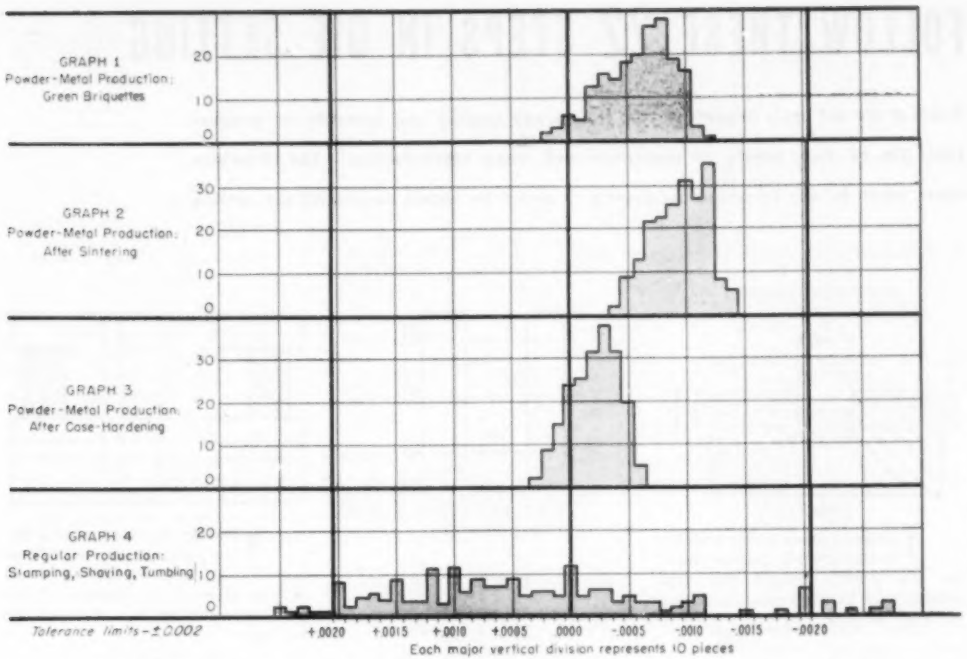
BUSINESS-MACHINE PART, formerly stamped, shaved and tumbled, is made more accurately by powder-metal process which also eliminates time-consuming milling operation required to hold dimension shown

Graph 3 shows the deviation after the same pieces have been carburized and hardened and have regained some of their bulk. Now the average deviation is only 0.0002 in., approximately 1/10 of the tolerance. Median deviation is 0.00015 in.

Graph 4 shows stamped pieces have an average deviation of 0.00045 in. and a median of 0.0001 in. Of the 200 pieces, 13 are beyond tolerance, therefore rejected.

These conclusions were drawn:

1. Powder-metal pieces, at any stage of processing, are all within the specified tolerance.
2. The range of error from specification is much less in powder metal than in stamped pieces. The spread in the former, as finished pieces, is only 0.0009 in., as compared with 0.0040 in. in the latter, not counting rejected pieces.
3. Powder-metal pieces fell into only 10 sizes; stamped pieces into 35 sizes, not counting 9 sizes or rejects.



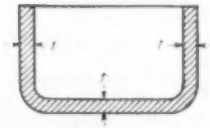
QUALITY-QUANTITY CHART compares dimensional accuracy achieved in lots of 200 parts made by stamping and by powder-metal process. Major vertical divisions equal 10 pieces, horizontal limits of graph are limits of tolerance on one critical dimension checked — ± 0.002 in.

4. Average deviation and median deviation are very close in the powder-metal pieces (0.0002 in. and 0.00015 in., respectively) and widely different in the stamped pieces (0.00045 in. and 0.0001 in., respectively).

5. The dimension checked was originally obtained by milling with difficulty because it was necessary to locate from a blanked surface. Because this one tooth is responsible for correct functioning of the part, the best accuracy consistent with high production is required. Conversion from conventional methods to powder metallurgy gave close tolerances, speeded production, and saved material by eliminating strip scrap.

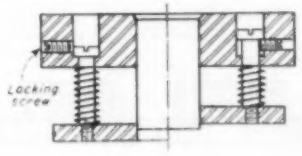
DIEMAKERS KINKS

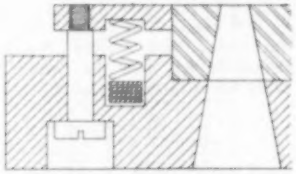
BY FEDERICO STRASSER



ALUMINUM SHELLS should be drawn so the wall and bottom thicknesses are practically the same as the original stock thickness. Therefore, tools made for steel and brass, where the reduction may equal 50%, are not used. Either the punch, the die, or both are changed.

MOVABLE STRIPPERS are troublesome during die-setting, because lack of punch visibility makes it difficult to set the punch to depth accurately. To hold the stripper up, provide a cross-wide screw.



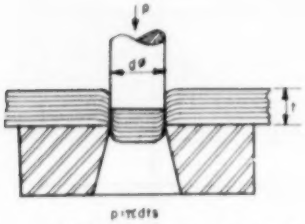


STRIPPERS in compound dies are usually spring actuated. To maintain constant spring pressure over many regrindings of the die, place 1/16-in. disks under the springs. After the die plate has been ground down 1/16 in., remove a disk and thereby keep the spring pressure approximately constant.

FOLLOW THESE 22 STEPS IN DIE SETTING

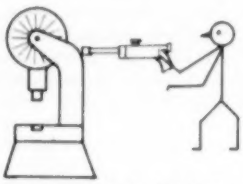
Correct die set up is important. On it depends quality and quantity of production, life of dies, safety of operators and many other factors. The drawings show what to do, in proper sequence, in order to obtain successful die setting

By FEDERICO STRASSER, SANTIAGO DE CHILE

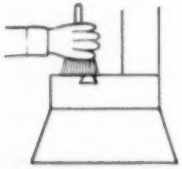


1 Select a press that is suitable to the general dimensions of the die (width, length and shut height) and to the required cutting pressure needed

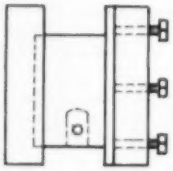
2 Shut off power and make sure that it stays off while setting the dies or making adjustments



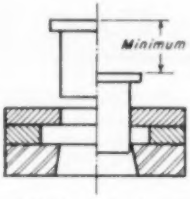
3 Check and lubricate the press. Take special care of the clutch and treadle. Nothing should be left near the treadle to cause harm to the operator



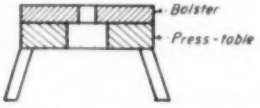
4 Clean the press table and the whole slide (inside and out) to remove oil, dirt and foreign matter that may be present



5 Check play of slide in its ways, and adjust, if necessary to proper amount

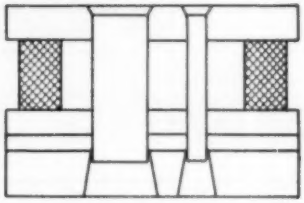


6 Adjust stroke length, making it as short as possible, compatible with working requirements of the die (check with Figs 12 and 13)

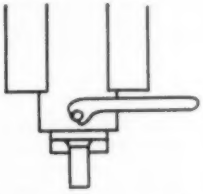


7 If necessary, select and mount on the press table a bolster-plate which should have: (a) adequate thickness, compatible with available die space and stroke, and (b) sufficient openings for blanks and slugs to pass through, but not so large as to weaken the die support, and (c) properly located tapped holes or T-slots to fasten the die member

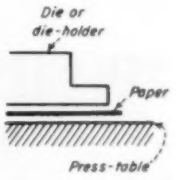
8 Put the tool in place upon the bolster-plate (without fastening it) and check whether all blanks and slugs can pass unhindered through the bolster and press table openings



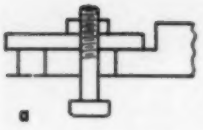
9 During handling of the die, the punch holder should rest upon bumper pins or spacing blocks so that there is no danger of the punches entering the die-openings too far

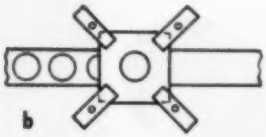


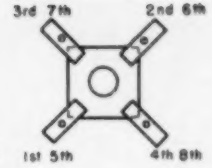
10 Put the slide in the down position and insert the punch-holder shank in the ram hole

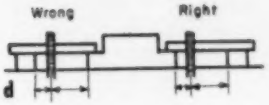


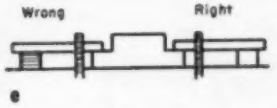
11 Put a sheet of paper under the die plate or die holder to avoid slippage of the tool







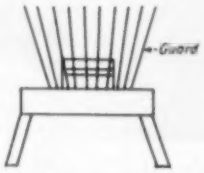




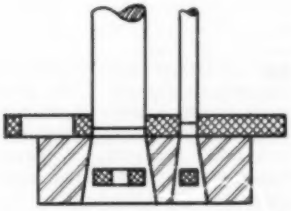
12 **Fasten the stationary part** of the tool to the press table or bolster plate. During this operation the punch must stay in its corresponding die opening. Observe these precautions: (a) use substantial clamps, bolts, nuts and fulcrum blocks; (b) clamps must not disturb feeding of strip and removal of the strip skeleton; (c) first draw up lightly all clamps and then tighten; (d) locate bolts as close as possible to the die holder, and (e) use as few pieces for fulcrum blocks as possible

18 **Re-tighten** all screws, bolts, nuts, etc

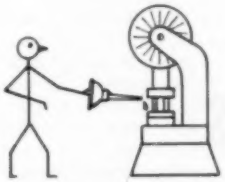
19 **Install automatic** or semi-automatic feeding devices



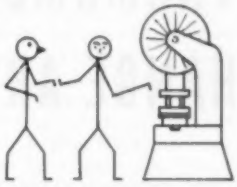
20 **Replace and adjust** all safety devices. These should provide maximum protection for the operator with minimum interference to the operation



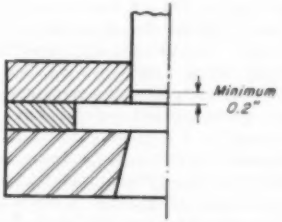
13 **Blanking and piercing** punches should enter die openings only so far that the shortest one will always sever its corresponding blanks or slug. Avoid metal-to-metal contact between punch and die plate by excessive penetration



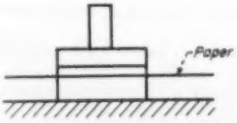
15 **Turn flywheel** by hand a few times and lubricate punches and other moving parts of the tool and die set. Then start motor and let the slide reciprocate several times without cutting



21 **Before handing over** the press to the operator, be sure that nothing is left near or in the press that does not strictly belong to the job

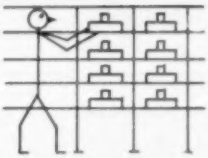


14 **Adjust press stroke** so that at the upper position of the slide, all punches are at least 0.2 in. above the stripping surface



16 **Try out new dies** with paper or cardboard before running the stock

17 **Cut a few blanks** and check them carefully. Look for burrs and study shear marks



22 **When the parts run** is completed, inspect the die before storage. If any tolerance weakness is found, the die must be repaired

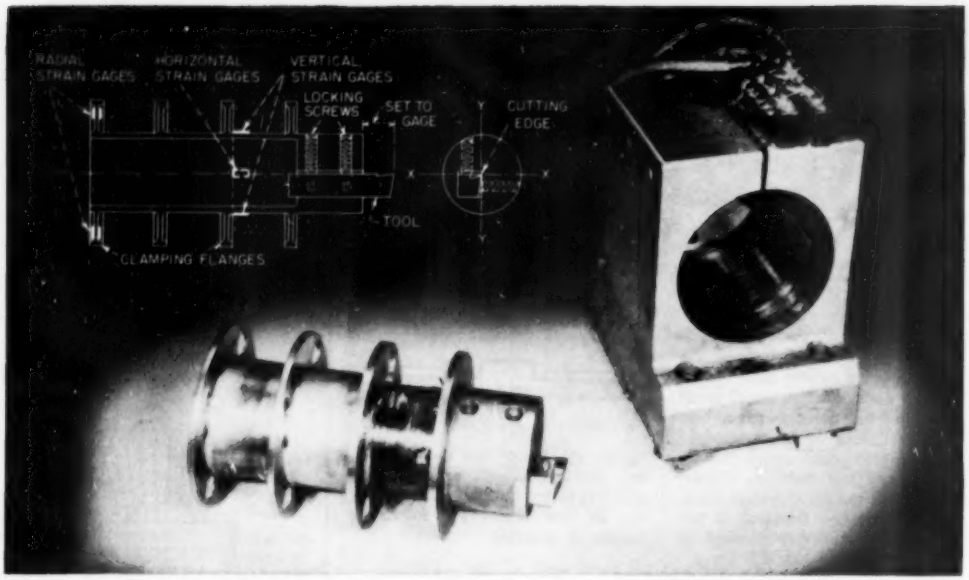


Fig. 1 . . . Refined design of J & L strain-gage dynamometer for turning. Tool support is a cylinder with one solid end containing opening for tool shank. Holder is clamped in split supporting block by three circular flanges

DYNAMOMETERS CHANGE ART TO SCIENCE

New units of the strain-gage type, capable of reproducing results in various labs, show increasing influence of machinability tests on production feeds and speeds . . . Latest J & L unit, for turning tests, shortens test times, covers all three components

BY E J TANGERMAN, Executive Editor

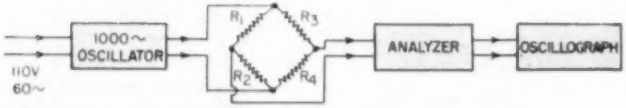


Fig. 2 . . . Circuit arrangement of the gage hookup for one load component. Standard strain-analyzer equipment operates through a Wheatstone bridge arrangement of the gages

MACHINABILITY wasn't much of a problem in the old days; alloys were simple, number of materials few, shop time a cheap commodity. Not until Frederick W Taylor, father of time and motion study, attempted to rationalize and analyze machining operations in the early 1900's did any practical man think much about it.

Techniques advanced rather slowly. The dynamometer, first applied to metal-cutting tests about 1901, wasn't really used to any extent until 25 years ago. Dynamometers were laboratory curiosities, fitfully applied to drilling problems by occasional professors. Schlesinger reviewed this early work (*AM*—Nov 21 '46, p 117) and reported development of a 2-element and a 1-element dynamometers for turning tests, later showed that Brinell hardness was no criterion of machinability (*AM*—July 17 '47, p 125). One of his dynamometers was brought to New York University a year or two ago, and Henriksen brought to Cornell one of his precision dynamometers about the same time, now being

applied to turning tests for the NMTBA. These, and those in use at other colleges, notably Michigan, Illinois and MIT, were all mechanical units. Several machine-tool builders, and perhaps as many large users, developed their own types for laboratory use.

But World War II gave tremendous emphasis to the trend toward more complex materials and higher cutting speeds as well as pushing wage rates up to heights that forced Metalworking to consider machinability and optimum machining rates with a practical eye. It also gave a lasting impetus to the application of carbides.

Various Approaches

There have been many different approaches. In turning alone, there have been such setups as those in which the tool is fed longitudinally by a constant feed load applied by dead weights over a pulley (feed load varied and effect on cutting action observed), mechanical dynamometers which measure tool loads through extensometers and dial gages (tool geometry and cutting conditions varied and tool load observed) and some in which cutting horsepowers or torques are observed while tool geometry and cutting conditions are varied.

Serious drawbacks limit the reliability and usefulness of results obtained by all these methods. Application of a constant feed load is an artificial condition not representative of actual metal cutting; mechanical dynamometers are affected by friction with its corresponding hysteresis, and sensitivity is limited by the need for rigidity of the tool support, and measurement of input torque or horsepower alone gives very limited information.

Recently the SR-4 strain gage, developed by Baldwin-Southwark, has offered a much more compact dynamometer design. Its electrical resistance varies as it is stretched or compressed, it can be attached directly to the surface of a tool support by cellulose cement, and it is very compact and accurate. First applications we heard about were in rotating units—the "torqmeter" of Greenfield Tap & Die for tapping tests, the MIT table unit for drilling (also used at Ford for Air Force studies), the Union Twist Drill spindle-mounted portable unit (*AM*—Mar 19 '51, p 144) and the General Electric private tests on radial-drilling CI with gun drills (*AM*—Aug 7 '50). It was significant that the MIT—Ford units were duplicates.

Turning is, however, a very basic machining method, and one in which conditions are readily duplicated. Furthermore, turning speeds have been moving upward at a rapid rate, now entering a zone around the 500-fpm mark in regular production, as compared with prewar speeds a third of that. Ford is using 1200 fpm on some jobs; experimental runs have been made at 1500 fpm. And it is in turning that the new materials are being encountered, and there that carbide tools have had their greatest application thus far. It is obvious that some compact equipment, readily duplicated and available for comparison tests in several locations, is needed. The method must be obviously realistic to the shop man, quick and easy.

Tool wear, as expressed by cratering and by the wear land developed on the side cutting edge of a turning tool, has always been a significant measure of tool life, but it has generally been necessary to interrupt a cutting test and remove the tool for accurate observation of wear-land development. It would be far preferable to be able to observe directly some other factor responsive to wear as the cut progressed, and use this other parameter as a control. It is also highly desirable to have a technique which permits imposition of any desired cutting conditions on the tool and which permits the measurement and visible recording of the three directional forces on the tool accurately and *continuously as the test progresses.*

New Dynamometer

About five years ago, Jones & Lamson built and tested the first such dynamometer. Results were so encouraging that the design was further refined to that shown in Fig. 1. In the case of a turning-tool dynamometer, the tool opening is so arranged that the cutting edge of the tool can be located, by setting gages, at the intersection of the X-X, Y-Y axes, thus eliminating torque loads on the holder. In the case of a facing-tool holder, the tool-shank opening is on center, and the tool itself is set so the cut is on center, to avoid torque loads on the holder. For measuring vertical load on the tool, a pair of strain gages is mounted (one on the top and one on the bottom of the cylindrical portion) where they sense the bending of the holder in the vertical plane from downward load on the tool. The gage on the top of the support is subject to elongation in tension as the support is loaded downwardly, and the strain gage on the bottom is subject to compression from the same bending action.

For measuring the horizontal feed load on the turning tool, cor-

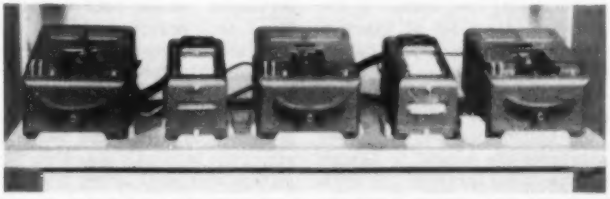


Fig. 3 . . . Outputs of the three strain-analyzers (showing vertical, horizontal feed, and radial loads) are connected to the two recording oscillographs between them. This gives maximum flexibility, because the horizontal and vertical load analyzers are on one double-channel oscillograph, the radial on one channel of the other. Thus instruments, on their portable table, can be used for other than tool-load measurements. Pressure pickups for hydraulic-circuit studies, slide-wire pickups for motion studies, and a 60-cycle timing wave for reference make it important to be able to group the instruments as required—for one, two, or three records at once

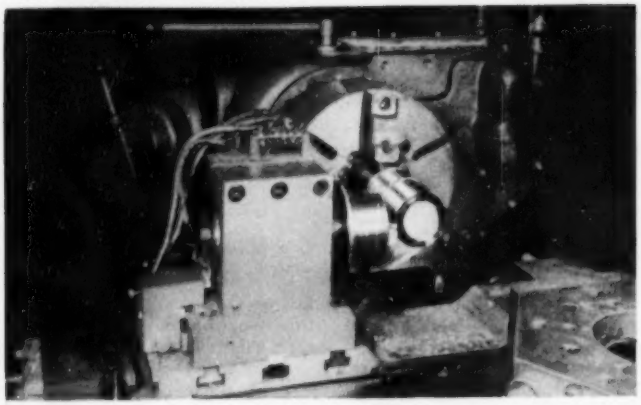


Fig. 4 . . . Toolholder and support are clamped to the cross-slide of the lathe

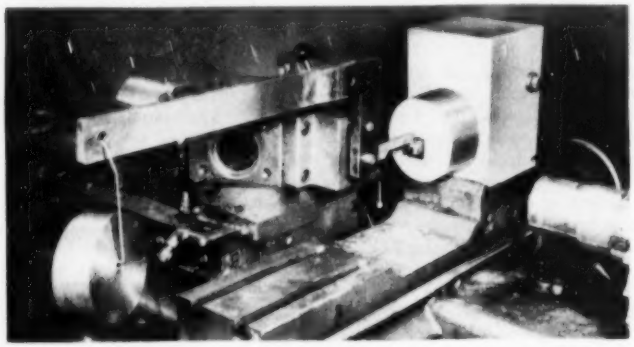


Fig. 5 . . . Dead weights on a lever-arm unit calibrate the system. Note working cover on toolholder

responding gages are fastened to the right and left sides of the cylindrical portion (on the Y-Y axis) and, again, one gage is subject to tension; the other to compression.

To measure the radial tool load (the horizontal load normal to the work surface), a set of gages is fastened to the rearward flange, one pair on the inner and outer faces of the top section, and one pair on the inner and outer faces of the bottom section. All three diaphragms are subject to flexure from the radial thrust of the work against the tool. Again, gages are placed to be subject to tension or compression from this flexure.

The strain gages themselves are standard SR-4 units attached directly to the metal surfaces of the tool support, in the locations described above, by a cellulose cement. When dry, they are wax-coated to exclude moisture which would affect their electrical characteristics, and the leads brought out to suitable instrument gages.

In the case of the vertical and horizontal strain-gage circuits, Fig. 2, the "active" gages, R-1 and R-2, are on opposite legs of the bridge, with standard resistances, R-3 and R-4, in the other two "inactive" legs. This bridge circuit is excited by a 1000-cps oscillator across the terminals indicated. The voltage measured across the other two terminals is directly proportional to the applied load from changes in electrical resistances of gages R-1 and R-2. If R-1 is the upper gage in the vertical system, its resistance increases, and the resistance of R-2 decreases, as vertical load is applied. The disturbance of the bridge balance is therefore a direct measurement of the strain or load at the gage points. In the case of the radial-load circuit, and in order to get increased sensitivity (because this is the smallest of the three loads on a turning tool) four gages are used, one in each leg of the bridge. Gages R-1 and R-2 are arranged so both are in compression, and R-3 and R-4 so both are in tension as the flange to which all four are fastened flexes under the radial load. This arrangement doubles the sensitivity which would be obtained with only two gages.

Strain - analyzer instruments contain circuit arrangements for balancing or zeroing the bridge circuits when no loads are applied. The instruments also contain controls for varying the sensitivity or amplification factors of the instrument outputs to the recording equipment. The recording equipment itself consists of standard pen-and-ink recording oscillographs on strip charts, observable directly as the tests progress.

How to Use the Equipment

To use this equipment, the toolholder and support are clamped to the cross slide of the lathe, Fig. 4, and the system calibrated with dead weights on a lever-arm, Fig. 5. In this picture, the setup for calibrating radial tool loads is shown, with the weight lever mounted on one face of the turret and a load link thrusting against a dummy tool carried in the toolholder. Moving this lever to other positions arranges vertical and horizontal loads corresponding to the other two cutting loads, and with known applied loads, the sensitivity of the system can be established *and thereafter accurately duplicated*. The experimental tool is then inserted with its cutting edge accurately set on the center line of the holder, the bridge circuit is balanced to a zero output indication, and the sensitivity adjusted to the desired scale value.

During the test cut, values of the three tool loads are charted by the oscillographs, Fig. 6. To operate this setup, two persons are generally required, one operating the instruments and the other ob-

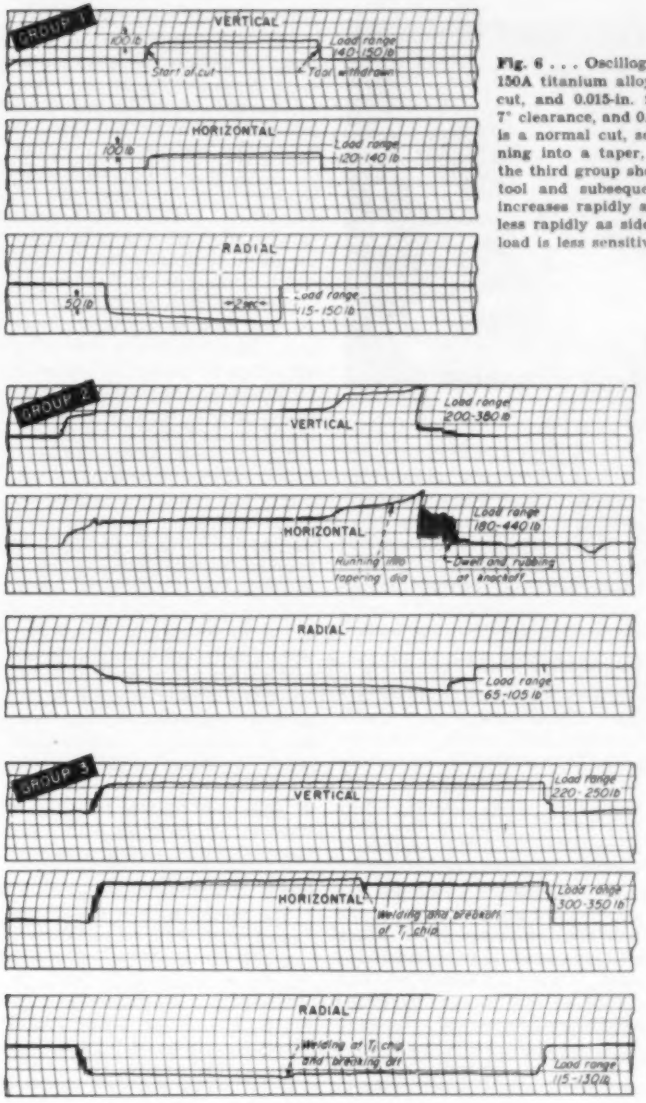


Fig. 6 . . . Oscillograph charts for three runs on 150A titanium alloy at 250 fpm, 0.050-in. depth of cut, and 0.015-in. feed. Tool had 10° side rake, 7° clearance, and 0.030-in. nose radius. First group is a normal cut, second shows both the tool running into a taper, and dwell and rubbing, while the third group shows welding of a Ti chip to the tool and subsequent breaking off. Radial load increases rapidly as tool wear develops, feed load less rapidly as side wear land increases. Vertical load is less sensitive to wear

serving the cutting action of the tool and operating the lathe itself.

This equipment provides several advantages. Sensitivity and accuracy are of a high order. Tool-load values can be consistently read within 2%. The equipment is free from hysteresis because there are no mechanical moving parts.

Repeatability of results is excellent as long as variables are held constant. Also, load values are plotted and are directly observable as the cut is taking place so interpretations can be made on the spot and experimental factors controlled as necessary to accomplish the desired results. Most significant is the fact that this equipment provides a means of measuring the progress of tool wear by direct observation of the increase in feed and radial loads. It has been found from observation of many hundreds of tests that there is a very accurate and dependable correlation of feed-load increase and tool wear. It is therefore possible to observe *while the tool is in its cut* how rapidly wear is developing at the tool point. This makes it unnecessary to interrupt the test for tool inspection and permits using the indicated load increase as a control in any test program concerned with tool life.

Tool Support Rigid

Rigidity of the tool support is adequate for cuts of significant dimensions without developing chatter, for loads of 500 lb at the tool point cause deflections there of under 0.001 in. Accurate location of the strain gages on their respective center lines effectively eliminates "cross-talk" between the vertical, horizontal, and radial load channels, and there is no measurable hysteresis in any direction, whether running cuts of increasing dimensions or decreasing dimensions. This is essential in obtaining accurate, repeatable results.

Illustrative of the work accomplished with this equipment are three significant programs. The first involved an extensive exploration of high-velocity carbide turning (500 fpm and up) in which the effects of metal structure, coolant, tool geometry, and cutting speeds and feeds were investigated. With such a large number of variables, it is necessary to have equipment which can give rapid and accurate data. The bulk of this test work was carried out in about three weeks and has been reported (*AM*—Nov 26 '51 p 144) in the ASME paper, "Carbide

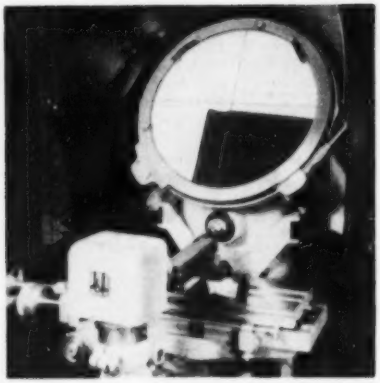


Fig. 7 . . . All variables must be accurately controlled. At J & L, tools are ground to a high surface finish, then checked on an optical comparator as shown here, and honed to eliminate feather edges or burrs

High-Velocity Turning."[1] The program involved approximately 500 individual tests, all cross-referenced and correlated.

A second investigation was of titanium turning.[2] In this program, tool wear was set up as a control by running each test until the horizontal feed load had increased 50% of the initial load at the beginning of a cut with a new sharp tool. The amount of titanium removed (in cu in.) up to this point of feed-load increase was used as a measure of performance of the tool. In this program, in only two weeks of testing and using only 150 lb of titanium, it was possible to evaluate 18 different grades of carbides, 6 different types of coolants and methods of application of coolants, a wide range of tool geometry and the entire range of practicable cutting speeds and feeds. In screening the different grades of carbides, for instance, it was possible to accelerate the tests by deliberately overspeeding the work beyond a practicable operating limit. Good correlation was observed between the rate of wear of the different carbides, whether running at a lower practical speed or at the higher accelerated speed. Such techniques as these, with reliable equipment, can shorten time of such programs considerably.

As a third illustration of the use of such equipment, J & L recently studied a precision deep-grooving operation on a heat-resistant alloy for a jet-engine part. In this program, within 12 hours of experimentation, and using some 30 lb of metal, cutting conditions and tool geometry were established which permitted raising production from a maximum of 8 pieces a day to at least 4 times that output.

Two Copies Made

Since completion of J & L's original dynamometer, two copies have been made by other organizations. In one instance, upon completion of the equipment, tests duplicating some of those run at J & L were made by the other organization and the reproducibility of results was excellent.

The implications of all this experience are many. This is, in the first place, a research tool which will give accurate quantitative results. It was Lord Kelvin who said "Until we can measure something and assign a numerical value to it, we don't really know much about it". This has long been a situation which has held back the development of reliable answers in the metal-cutting field. We have here, also, equipment which makes possible reproducible experiments and the standardization of experimental techniques with the related possibility of assigning different phases of a metal-cutting program to different organizations. The accumulation of reliable information could thereby be much accelerated. The titanium program described above could not have yielded the information obtained by any other means, and a corresponding program of tests would have taken many times as long by any other method and still not have given as informative results as were obtained, and with the small amount of critical material actually used. Equipment of this type, easy to manipulate and giving reliable data rapidly, enlarges many times the scope of metal-cutting testing which is economically feasible.

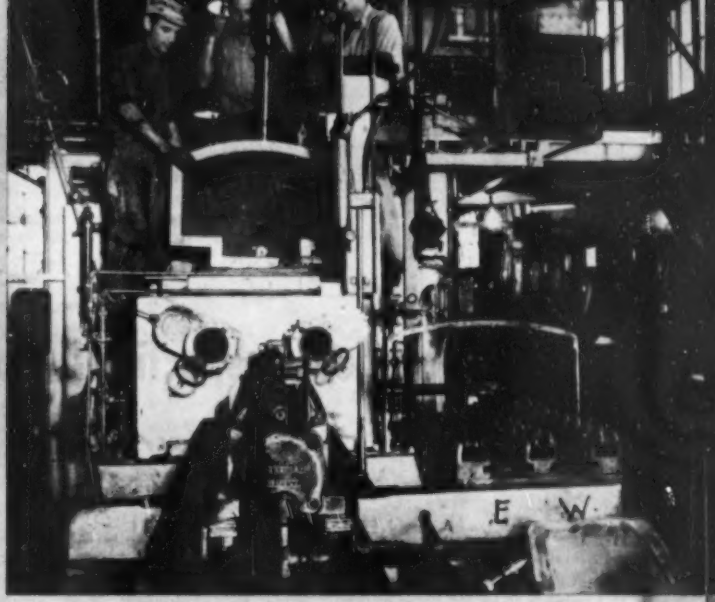
It also provides a means for developing data for educational purposes. In attempting to extend the utilization of carbide cutting tools, for instance, it is possible to show curves, graphs or tables which are convincing at once to the user.

As experience with such techniques becomes more wide-spread, it may also result in a general revision of ideas on "machinability". It may be entirely improper to consider machinability as a unique characteristic of the metal alone. The nature of the tool (its material and its geometry), the application of different types of coolant and variations in cutting conditions, would seem to make it impossible to say that any one metal has a particular "machinability index" compared to another. As we learn more about the nature of metal-cutting, we may find it necessary to establish some other criterion which is more realistic.

Other Applications

The development of this strain-gage dynamometer for metal turning has also given rise at J & L to other applications such as strain-gage dynamometers for measuring cutting forces during threading operations, for analytical work on tool chatter (the equipment is responsive with high accuracy to frequencies as high as 100 cps) and to applications by other organizations, to drilling and tapping experiments and milling and grinding studies. A better understanding of available experimental techniques such as this will go a long way toward rapidly solving some of the problems of metal cutting which have always been a puzzle. It could well be that the "art of metal cutting" is becoming the "science of metal cutting."

[1] *Reprints available: Dept. 710, Jones & Lamson Co, Springfield, Vt.*
[2] *Specific information on this project is still Government classified at time of writing.*



Installing replacement cold valve in charge end of muffle-type gas carburizing furnace

HOW TO MAINTAIN HEAT-TREATING EQUIPMENT

BY T A FRISCHMAN, Chief Metallurgist, Axle Division, EATON MANUFACTURING CO

Most heat-treating equipment functions under adverse environments of high temperature, corrosive gases, temperature changes and thermal and mechanical stress. These conditions make the equipment more sensitive to failure than other production facilities like machine tools.

As a rule, productive capacity of heat-treating equipment closely matches that other manufacturing facilities, to bring the whole in balance for a given output rate. Any breakdowns of heat-treating equipment therefore impair or stop plant production.

Avoidance of breakdowns should receive as much attention by management as high output of the equipment. Both go hand in hand in producing quality and quantity. Often, serious consequences and extensive repairs are avoided by making timely inspections, and then proceeding with needed repairs as soon as feasible.

Preventive maintenance programs are not self-starting nor are they self-sustaining. When once put into force, their provisions must be enforced with regularity by all departments involved. Even so, situations occur where immediate enforcement of the entire program becomes impossible because of contingencies. In cases like this, a compromise between uninterrupted production and proper upkeep must be made. Successful preventive maintenance programs depend upon regularly scheduled routine inspections and immediate availability of replacement parts.

American Machinist SPECIAL REPORT No. 320 TO THE METALWORKING INDUSTRIES

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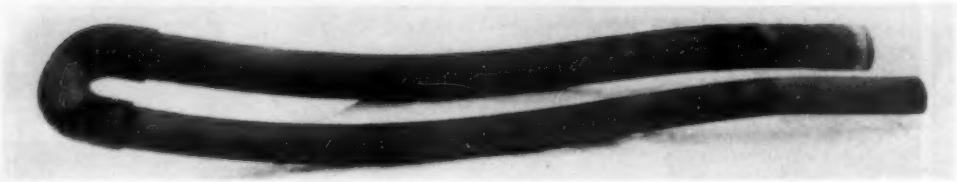


Routine maintenance inspection found this sagged radiant tube. A badly sagged tube can pile up work in the furnace and cause shutdowns

How to Schedule Inspections and Repairs

THE BASIS for preventive maintenance of heat-treating equipment is regular inspection. The point is to locate signs of trouble before it occurs. In setting up routine inspection schedules, several factors must be considered:

FIRST the frequency of inspection:

Experience is valuable, because past history of the equipment affords a reliable basis for determining how often inspections are to be made. Depending upon type of equipment and its many appurtenances, frequency of inspection may be as often as one hour to as far apart as one year.

In making routine inspections, all component parts should be examined carefully for signs of failure. Estimate how long the equipment can be run before failure takes place. This sounds easy. Actually, estimating failures as far ahead as one year is not simple. Nevertheless, forecasts so far ahead are not uncommon. Moreover, they are necessary, because major replacements of furnace parts like large heat-resisting-alloy muffles and discharge hot valves, require long delivery times, especially in national emergency periods.

SECOND who should make inspections?

Ordinarily, inspections are made by the maintenance department. The maintenance supervisor, millwrights, pipefitters, electricians, and sometimes brickmasons go over the equipment. Each group checks the details of interest to its trade.

Most repairs and cleanings are made when the equipment is down for scheduled inspection. Items that cannot be taken care of then should be listed so their repair will not be overlooked at a suitable time.

A large portion of heat-treating equipment involves simple maintenance procedures for inspection and repair. However, with large heat-treating furnaces these procedures become complicated and extensive. Some large furnaces require cooling down for three days before workmen can enter them

TYPICAL ITEMIZED LIST OF REPAIRS ON RADIANT-TUBE GAS CARBURIZING FURNACE

1 . . Burn carbon.
2 . . Vacuum clean.
3 . . Provide a trough under the packings at the charge end of the furnace to catch leaking oil.
4 . . Repair packing on No. 3 pushing cylinder.
5 . . Weld shut the small crack in the casing to the left above line No. 1.
6 . . Determine location and repair oil leak or leaks in inner charge door.
7 . . Blow clean all atmosphere and natural-gas lines including the effluents on the charge and discharge end of the furnace into the vestibules.
8 . . Repair washing machine.
9 . . Tighten up all hydraulic leaks.
10 . . Flush inner oil-cooled charge and discharge doors, to clean out sediment from the circulated quenching oil.
11 . . Drain and refill hydraulic oil tank.
12 . . Starter for pump in pit has no cover. This is dangerous due to arcing when switch is turned on.
13 . . Rearrange piping to provide a 45° angle on discharge effluent line from furnace to vestibule. Present arrangement does not permit removing plug for rodding or cleaning.
14 . . Any other items that need attention that are not listed above.

comfortably. After inspection and repair, two days or more may be required to heat the equipment to operating temperature. Thus, several days of productivity can be lost. Intelligent preplanning of shutdowns is necessary to avoid oversights and mistakes.

THIRD how to plan maintenance

To realize successful preventive maintenance, plan what is to be done before shutting down the equipment. Hold meetings with personnel representing maintenance, heat-treat, production, metallurgical and mechanical departments. It will be found that many details, not thought important to one segment of the group, will actually prove vitally important to another sub-group. Free discussion will bring out all items necessary of attention in the repair or inspection procedure.

On some occasions, it is a good plan to invite representatives of the company that built the equipment. Their counsel and suggestions are often helpful and time-saving.

After thorough discussion of the problem, prepare an itemized list of exactly what is to be done. Distribute copies to plant personnel who attended the meeting. Thus, nothing is left to memory and a useful record is created for future use.

After making the inspection and repair, this list should be amended with new items found to require replacement or repair. A better record will then be available for the next time. A well-prepared list prevents oversights when ordering replacement items. It shows what items were used and which will be needed again in the future.

The sagged radiant tube shown was removed from service in a continuous gas-carburizing furnace after six years of service at 1680 F. Poor condition of the tube was uncovered during regular inspection for maintenance. The tube had not failed in the sense that it would not heat effectively, because it had not burned out. But the sag permitted the tube to come dangerously close to stacked workpieces as they traveled through the furnace.

MONTHLY ALLOY INVENTORY RECORD

VENDOR'S NO.		MIN. IN STOCK	NEW	USED
	4-ROW CARBURIZER			
SA-3211 Q-11988	Tray	30	35	5
EB-3278	Pinion fixture assembly - 21 hole	12	24	5
EB-3277-A	" " " - 12 hole	15	14	6
EB-3279	" " " - 9 hole	20	8	2
EB-2859-B	Centering ring #1 1-13/16 in. ID	40	20	12
EB-2860-A	" " #2 2-1/4 in. ID	40	20	15
EE-3063	" " 1-9/16 in. ID	40	none	10
EB-2859-B	Spacer #1 ¼ in. lg	20	20	100
EB-2859-B	" #2 1⅜ in. lg	20	none	125
EE-3033	Short pin	200	200	0
EE-3033	Long pin	100	none	0
Q-13378	Fixture assembly - 16 drive pinions	15	8	15
Q-13518-B	Adapter - 1¼ in. ID	50	60	75
Q-13379	Fixture assembly - 9 drive pinions	10	5	15
Q-13518-A	Adapter - 1⅞ in. ID	50	500	50
	POT CARBURIZER			
EB-2812-A	Tray	30	45	15
B-10838	Pot	40	5	10
	Pot cover	40	166	0
	Cam box	6	6	2
E-8044	" " cover	12	12	4
E-8044	" " " tie bar	6	6	2
E-8044	Test pin	1000	1000	

If the tube had not been removed in time, a pile-up of workpieces within the furnace would have resulted in an emergency shutdown and scrapping of scaled parts.

Why Replacement Parts Should Be on Hand

By having replacement parts available, prolonged down time is avoided for repairing heat-treating equipment. Heat-resistant furnace parts frequently fail unexpectedly. Sufficient spares of "hard to get" items must be kept on hand, if the equipment is to be quickly returned to operation. Many furnace parts are specially designed castings not stocked by the furnace builder. This holds true also for non-standard, high-temperature, insulating-brick sections, electrical heating elements, high-temperature fans, insulators and many other critical parts. Obviously, a complete set of duplicate parts cannot be kept on hand for the entire equipment in a heat-treat department. In lieu of this, careful planning is required to maintain inventories of necessary spares and supply items. The typical inventory list illustrated serves the purpose well.

Because of high investment, the tendency is to pare down the spare-parts inventory below safe levels. Various methods for controlling these items are employed by different plants. In some, control is administered by the heat-treat personnel or by the plant metallurgist. In others, maintenance supervision, plant engineers or storekeepers may do this work. The important thing is not so much who does it but how thoroughly it is done and whether good results are obtained.

In medium to large heat-treat departments with many different types of equipment, inventory control of spare parts and supply items amounts to a considerable task. A plan that yields good results is one where the spare-parts inventory is based in part or entirely on the equipment-manufacturer's spare-parts list, plus actual working experience with the equipment. Fre-

quently, the manufacturer, to be on the safe side, recommends a large number of items totaling a sizable cash expenditure. It is possible to reach a compromise between an inadequate supply and overstocking by discussing the probable life of each part with him. Then regulate purchase of replacement items so that delivery is made close to the time of repair. This practice avoids stocking some items for a year or more.

Frequency of Inspections

Operating instructions for heat-treating furnaces should incorporate a section pertaining to furnace maintenance. On a large continuous, automatic, special-atmosphere furnace, for example, many items require checking. Some need checking as often as once an hour, whereas others may not need attention for months. Items requiring frequent attention are easy to remember. Those that need infrequent attention pose the problem. To be sure of coverage in all cases, a definite repair program or schedule should be provided. To make certain of accomplishing this, state in the operating instructions what, when and how each item should be inspected. Further, check sheets can be employed, to record when each item has been taken care of in accordance with the prescribed schedule. Check sheets do not necessarily follow a set pattern.

What to Look For in Furnace Maintenance

Of the many facilities making up heat-treating equipment, furnaces require the most maintenance. Biggest expense is the upkeep and replacement of heat-resistant alloy items such as retorts, muffles, radiant tubes, heating elements, supports, hearth plates, rails, rollers and kindred parts. Other things being equal, the service life obtained from the alloy depends on the care it receives. Overloading is a major cause of failure. If overloading is avoided, repairs are reduced in number and severity.

Other important factors that influence frequent replacement of heat-resistant alloy are: furnace design, type and rate of heating, operating temperature and furnace atmosphere. Corrective steps can usually be taken if repairs become too costly or frequent. In a situation like this, consult the furnace builder. It may not be possible to redesign the entire equipment, but it is frequently possible to alter some of the failing parts or protect them so that they give satisfactory service. The same can be said of the heating appurtenances. If furnace parts continue to "burn away" prematurely, the heat-input is too intense and it is being applied too steadily. Excessive maintenance on this score is also capable of solution by consultation with the furnace builder.

As a rule, the higher the operating temperature the more maintenance furnaces require. This is due: (1) to reduction in creep strength of the heat-resistant alloy with increasing temperature; (2) gradual dimensional reduction of the furnace parts by scaling when operating in oxygen-containing atmospheres; (3) accelerated deterioration of the brickwork, and (4) warpage, causing improper functioning of the moving parts, thus introducing extraneous stress.

Effect of Furnace Atmosphere on Maintenance

Type of furnace atmosphere has an important bearing on the amount of maintenance the equipment requires. In direct or open-fired furnaces using either gas or oil, heat-resistant alloy deterioration proceeds at a faster rate than in certain types of controlled-atmosphere furnaces, because of unhindered oxidation (scaling). It is possible to decrease the rate of deterioration somewhat by reducing the amount of excess air in the combustible mixture. However, going too far in this direction results in decreased efficiency in fuel consumption and also lower heat input to the furnace.

Maintenance of alloy furnace parts is less with electrically heated furnaces, except perhaps for replacement of heating elements. Longer life is attributable to absence of corrosive products of combustion.

Replacement of parts in so-called "clean" furnace atmospheres free of soot forming constituents is also less frequent than in open-fired types. These atmospheres or-

RECOMMENDED SPARE PARTS LIST FOR RADIANT-TUBE CARBURIZER

PART NAME	TYPE ALLOY	DRAWING NUMBER	QUANTITY	
			On Fce.	Recom. Stock
Door Muffle	35-15	42767-B	1	1
Pushout Arm	NC-4	60981-A	1	1
Pier Cap	"	45890	6	1
" "	"	45891	1	1
" "	"	45892	1	1
2½" Rails	"	45889-A	5	2
2⅛" "	"	45889-B	4	2
2⅛" "	"	37071-A	30	6
2¼" "	"	37070-C	24	4
Rail Keys	"	7937/L	98	24
Pedestal	"	C-36647-A	2	1
Hold Down Casting	"	36647-BR	1	1
" " "	"	36647-BL	1	1
Stools	"	23126-A	6	2
Bracket	"	22820-A	12	2
Keys	"	24773-A	12	2

TYPICAL INSTRUCTION SHEET FOR FURNACE MAINTENANCE

Weekly Maintenance on Monday, by Day-Shift Operator

1. Clean filter in hydraulic-oil tank unit.
2. Check oil seal on discharge end of furnace for correct level and fill with Quenchol "G" if necessary.
3. Inspect chrome or seals on roof, hot valve and charge end. If ore becomes crusted, then change it.
4. Thermocouples to be checked by designated person.
5. Burn carbon out of RX generator when furnace is not operating. The burning operation should require from 12 to 24 hr, depending upon length of time between burnouts. See instructions for burning carbon out of tubes on page 14 of Surface Combustion Manual, RX Instructions.
6. Clean RX spud in mixing "T" and RX flow gage when not in use.
7. Lubricate positive pressure pump on RX unit with Sohio 82X grease and Sohio DE52 medium turbine oil.
8. Drain water out of closed cooling system. Refill with water and add ¼ lb of Alken condenser treatment powder completely dissolved in water, as rust preventive.
9. Check for gas leaks at throat of burners with a torch. If leaks are found, notify foreman to have Maintenance Department tighten the bolts or replace packing.
10. Packing glands to be inspected and checked for leaks with a torch.

Four-month Maintenance (See tentative schedule 4-21-52)

1. Shut down and cool the RX unit.
2. Burn carbon out of furnace for 18 hr or more, if needed. See page 6 of Operating Instructions B-7030 revised 5-15-50 for burning carbon.
3. Shut down and cool furnace.
4. Remove and clean orifices in gas line in each radiant burner.
5. Clean spuds and venturi on inspirators to pilots.
6. Clean all pipes from RX unit to furnace and inlet gas lines at furnace.
7. Blow out radiant tubes with compressed air.
8. Check all pressure gages for zero reading.
9. The Maintenance Department shall examine the explosion head on the mixed-gas header under the RX unit. If necessary, replace with Empire cloth or its equivalent.
10. Have Minneapolis-Honeywell control valves cleaned and oiled. Use only Finol or a good grade of light oil in the two holes on the side of the motor.
11. The Maintenance Department shall vacuum clean and hand-brush the interior of the furnace.
12. The hydraulic oil tank shall be checked for dirt, sediment and water. Drain and clean if necesary. Refill with a mixture of 95% Sohio DE52 medium turbine oil and 5% butyl-cellosolve.
13. The Maintenance Department shall clean blowers supplying air to the burners.

The filters on two air blowers shall be cleaned every six weeks by an outside contractor.

15. Clean V-slot below hot valve and make valve stem adjustment if necessary.

Yearly Maintenance (Approx. August of every year)

In addition to the items given in 4-month Maintenance, the following items should receive attention:

1. Remove catalyst from RX tubes. Examine it for fusing and general condition. Replace with new catalyst if necessary.
2. Remove top covers and coolers and clean carbon out of cooling tubes and reaction tubes.
3. Examine strainers in gas and water lines on RX unit and remove dirt and foreign matter from screens.
4. Remove drain plug at lower end of each cooler on top of RX unit and inspect for sludge, lime deposit and corrosion. Remove any deposit found.

dinarily exclude oxygen but may contain carbon dioxide and water vapor, which form scale when present in sufficient quantities. However, the scale-forming tendencies are low by comparison with open-firing. Prevention of scale aids in maintaining the original dimensions and strength of the furnace parts.

Soot Deposition and Removal

Maintenance is high with furnaces employing soot-forming atmospheres as in carburizing and carbo-nitriding operations. Soot deposition on workpieces, internal furnace parts and brickwork results from thermal decomposition of methane, propane and oil vapors. When furnaces are in steady production, soot continues to deposit in voids, openings, crevices, joints and cracks within the furnace interior. This build-up can reach harmful proportions if not removed in time.

In pit-type retort carburizing furnaces employing either high-methane-content gases or oil vapors as the carburizing medium, an inspirator or suction apparatus is used to pull out the carbon deposit. Some plants find it more feasible to burn soot out between charges. Others rely on long-handled scoops to remove it.

Some pit-type furnaces are constructed so that, if loose carbon is allowed to accumulate in the bottom of the retort, circulation of carburizing gases ceases, thereby causing improper carburization. Accumulated solids are not, however, always composed solely of carbon. Lumpy particles which did not burn away, though appearing to be entirely of a carbonaceous nature, were analyzed and found to contain 0.10% carbon, 24.6% nickel, 12.5% chromium, 45.8%

Table 1—CHARACTERISTICS OF SOOT DEPOSIT IN RADIANT-TUBE GAS CARBURIZER

	LOCATION OF DEPOSIT	
	(a) Ten feet into charge end between furnace rails	(b) Furnace floor, discharge end
% combustible during 1-hr ignition period	92.3%	38.0%
Appearance of deposit	Black, magnetic and lumpy	Red, magnetic, finely powdered
% combustible after a 24-hr furnace burnout	0.5%	0.5%
Appearance of deposit	Red-brown magnetic powder	Red-brown magnetic powder

Incombustible residues composed chiefly of iron, nickel and chromium oxides

iron, and remainder oxygen. Thus, the deposit was traceable to oxidation and deterioration of the heat-resisting-alloy furnace parts and work-supporting fixtures.

Continuous Furnaces

Soot removal in large continuous-type carburizing furnaces requires regular attention. Partial removal is made possible by burning out the carbon at periodic intervals. To do this, maintain a temperature of 1550 F in the furnace while keeping the doors and sightholes open.

Some modern carburizing furnaces admit air from the furnace blower through specially provided ports along the sides near the bottom of the furnace chamber. The deposit is not necessarily composed of carbon alone. Compounds of chromium and nickel, mostly oxides, resulting from deterioration of heat-resistant alloy, as well as grits from the brickwork, have also been found by analysis. See Table 1. Occurrence of these substances along with carbon or soot accounts for the reason that "burnouts" alone will not suffice in keeping a furnace like this clean. The solution is to clean the interior by use of an industrial vacuum cleaner after carbon burnout, which breaks up the hard caked deposit into a powdery form. Vacuum cleaning should be performed about every four to six months, and sometimes more often. Deposits on top of the tubes, around the supports, brackets and rails should be brushed off if any remain after suction cleaning.

Careful cleaning as described affords a good chance for inspection of the inside condition of the furnace and its internal heat-resistant alloy parts. If burnouts and vacuum cleanings are neglected, pitting of the furnace alloy results, and failure is hastened. In some instances carbon deposits have virtually covered portions of bottom-positioned radiant tubes, resulting in their premature destruction by localized overheating.

Pot-Type Furnaces

Externally fired pot furnaces are not a big maintenance problem if conscientiously watched. Maintenance naturally is more frequent when furnaces are operated within temperature ranges for cyaniding and hardening than for annealing and tempering.

In furnaces using either oil or gas, burner adjustment and prevention of flame impingement are vital to long pot life. Salt level is likewise important. If the bath line is allowed to recede too low, the upper portion of the pot within the heating chamber will quickly fail. There will be no molten salt at this location to conduct the heat away. The cause of frequent brick relining jobs is often traced to molten salt seeping down between the pot and interior brick lining of the furnace, resulting in chemical reactions between brickwork and salt. Proper setting of the pots cannot be over-emphasized.

Furnace flues in externally fired pot furnaces should always be kept clean and open, to eliminate too high a back pressure in the combustion chamber. Heavy sludge accumulation in the bottom of the pot from salt breakdown is another source of localized overheating, because circulation is obstructed, thus causing "hot spots."

In operation of immersed-electrode, salt-bath furnaces, low maintenance expense is secured by proper adjustment of electrodes, if possible. Care in this respect is repaid many fold in electrical efficiency, heating speed and good over-all operation. Sludge must also be removed at regular intervals: (1) to avoid interference with travel of workpieces through the furnace, (2) to prevent fouling of the electrodes, (3) because it reduces the working volume of the salt, and (4) because control of the bath becomes more difficult as it gets out of balance chemically.

Electric-Furnace Problems

As a rule, heating elements require the most maintenance in electrically heated industrial furnaces. With use the elements eventually "burn out" from higher resistance caused by reduced cross section as a result of scaling.

Overheating and short-circuiting also contribute to maintenance problems, but this source of trouble can be held to a reasonable minimum with proper furnace operation. Heating elements suspended from the top and sides of furnaces are not as vulnerable to accumulated dirt and scale as hearth elements. If not carefully watched, hearth elements soon become embedded and thus overheat. This is especially true with furnaces employing soot-forming controlled atmospheres. To avoid this trouble, clean the elements periodically by brushing, blowing, or vacuuming.

Burned-out heating elements can be repaired by welding. The failed section is removed and the two ends are welded together, or a partial new section is inserted. Sometimes it is feasible to weld in usable sections from other failed elements. This practice frequently turns out better because the electrical resistance of the "welded-in" used section is higher than new material, and therefore more closely matches the resistance of the section being repaired. General practice is to make two or three repairs and then replace with entirely new sections.

Heating elements tend to elongate and distort in service. They eventually sag and buckle far enough to cause short circuits and burn-outs. Periodic inspection for warpage means that sagging elements can be put back in proper position before damaged beyond easy repair. Loose connections at heating element terminals should be detected, because this condition creates improper furnace performance as well as burning of the terminal connectors due to high resistance.

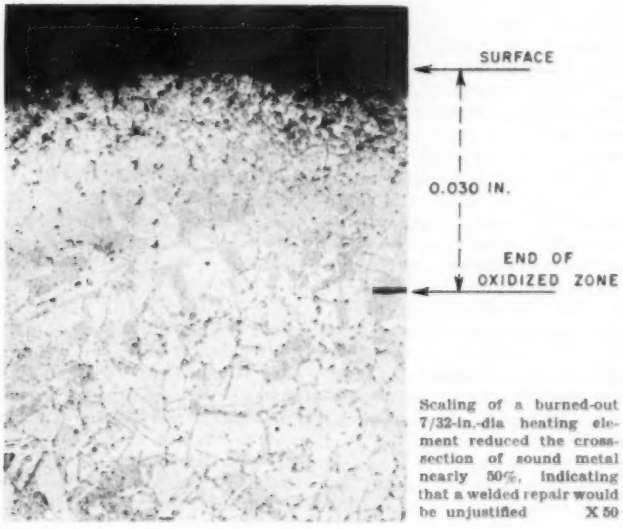
Controlled-Atmosphere Generators

Endothermic-type, furnace-atmosphere gas generators require more maintenance than the exothermic type. This is because carbon (soot) tends to deposit in the gas-cracking tubes and throughout the catalyst, especially when the generator is operated on the rich side. If carbon deposition is excessive the desired chemical reactions in the cracking process will not take place and gas of improper composition will be produced. To be assured of obtaining reformed gases of desired composition, a schedule of periodic carbon burn-outs should be followed. To be on the safe side, complete replacement of catalyst in generators every two years is a good plan. The expenditure is more than offset by savings resulting from uninterrupted production of the gas generating unit.

Controlled-atmosphere generators usually include a water-spray cooling tower to reduce the temperature of the reformed gas before it enters the furnace chamber. These towers are frequently packed with ceramic rings, slugs, flats, etc, which retard gas passage and thus enable better heat transfer. In some exothermic generators, water is sprayed over the ceramic substances to promote greater contact between gases and coolant water. In time these materials and filtering screens become covered with incrustations and slime to the extent that the gases cannot flow freely.

When this happens, the generator should be shut down for cleaning. The deposited substances can be removed from the ceramics by soaking them in 10% sulfuric-acid solution maintained at 160 F.

Another aid to reduced maintenance on gas generators is to take in air for the cracking mixture from outside the building. Usually, air within the heat-treating department is not clean enough to prevent fouling of pipes, measuring gages and blowers. If air cannot be taken from the atmosphere, install air filters on the inlet side of the air-supply lines. These filters require periodic cleaning or replacement in order to maintain efficiency of the equipment.



Scaling of a burned-out 7/32-in.-dia heating element reduced the cross-section of sound metal nearly 50%, indicating that a welded repair would be unjustified X 50

Pipe Lines and Gas Inlets

Pipes conveying controlled-atmosphere gases and supply air to furnaces must be cleaned periodically with highly compressed air. The same applies to orifice plates and controlled-atmosphere inlets to the furnace chamber. Even though supply air is filtered, a certain amount of dirt and moisture is entrained and in time will cause fouling of the lines. Some controlled-atmosphere gases are formed under certain conditions with high enough dewpoints to rust the inside of the steel pipe lines. From time to time this scale or rust must be removed lest particles lodge against or completely cover orifices (small openings) in the supply lines. Plugged inlets to the furnace chamber are usually indicated when flow of generator gas into furnace decreases from normal for no particular reason.

Hydraulic-Oil Pressure Systems

Hydraulic-oil pressure systems are used to a large extent on modern heat-treating furnaces for imparting motion to doors, pushers, cross-overs, extractors, elevators lowerators and the like. These systems require attention. If sediment is permitted to accumulate, trouble develops in the solenoid-operated valves. If hydraulic-oil is subject to high operating temperatures, a 5% addition of butyl-cellosolve aids in dissolving the so-called "varnishes," which are thrown out of the oil when in contact with heat. Thus, sticky valves and seizures can be avoided. It is a good plan to centrifuge hydraulic oil periodically, or better still to replace it at regularly scheduled intervals.

Good furnace practice requires that all motions on large automatic furnaces be kept in proper timing. There is a tendency for them to change over extended time periods from wear and leakage of the packings and other causes. When the furnace is operating as desired, all motions should be timed and recorded. At periodic intervals these

Table 2—TIME SEQUENCES OF OPERATIONS FOR RADIANT-TUBE CONTINUOUS GAS CARBURIZING FURNACE

		SECONDS	
		STD	ACTUAL 3-11-52
Pull-Out	Forward	3	6
Pull-Out	Return	10	8
Push-Out—Cross Push	Forward	20	20
Push-Out—Cross Push	Return	8	7
Push-Out—Hot Valve	Up	9	11
Push-Out—Hot Valve	Down	6	7
Charge Car	Out	24	11
Charge Car	In	20	17
Charge Vest. Door	Up	31	34
Charge Vest. Door	Down	50	95
Charge #1 pusher	Forward	34	34
Charge #1 pusher	Return	16	16
Charge #2 pusher	Forward	38	43
Charge #2 pusher	Return	18	18
Charge #3 pusher	Forward	34	38
Charge #3 pusher	Return	16	15
Charge #4 pusher	Forward	36	38
Charge #4 pusher	Return	16	14

motions should again be timed and adjusted in accordance with the standardized intervals. Table 2 shows a record of standardized time motions and the timing that was found at a later date on a large automatic, continuous, gas-carburizing furnace.

Cooling-Water Systems

One or several cooling-water systems are generally to be found in heat-treating departments, particularly where a wide variety of furnaces are used and the production is large. Some modern large continuous heat-treating furnaces employ water-cooled doors, packings, slots and other contrivances. If the cooling water is not treated to reduce the inherent hardness of the water, rusting and incrusting effects continue unabated to cause eventual failure.

In plants operating their own chemical laboratories, control of the water treatment of these units can easily be achieved and thus cut down unnecessary maintenance. Smaller plants not equipped with laboratories can either purchase kits for making water-hardness analysis or can hire outside specialists.

To reduce maintenance on heat exchangers employed for cooling of quenching oils, it is virtually a necessity to treat the water side of the cooling unit as well as flush it out with appropriate solutions on a regular schedule. From time to time the oil side of heat exchangers should be drained and the tubes flushed with a hot-alkaline solution made up of about one ounce of any good proprietary cleaner to a gallon of water. If the coating is too dense or stoppage is complete, it is usually possible to "break" the oil-bound deposit with a solvent such as trichlorethylene used cold, if it is allowed to digest the deposit for several days. The dirty cleaning solution can be stored for the next cleaning or can be distilled for other uses.

Maintenance of Gages

Perhaps the most neglected items in heat-treating equipment are gages, whether of the manometer or pressure dial type. There usually are so many of them, sometimes 20 or more on a single furnace, that it becomes a chore to look after them diligently. Where many furnaces are in use in a single department, the task of keeping gages in good order is a sizable one.

The main problem with liquid manometer gages, whether employing oil, mercury or water in the column, is to keep them from leaking and to keep the sight glasses clean. Leaks develop in the seals between reservoir and glass tube and sometimes in the drain plug. Some mechanical dial-pressure gages occasionally go off calibration. When this is suspected, the best thing is to replace the gage with a new one or check it against a known standard. So much depends on accuracy of gages that provisions for regularly checking them should be provided in the maintenance program.

Washing Machines

Washing machines used to remove oil from workpieces perform a much needed function, when low-temperature tempering (300 to 500 F) follows hardening. If oil is not removed, profuse smoking occurs in the tempering furnace, besides causing generally dirty conditions within the furnace, hoods and circulating fans. Further, if the tempered workpieces are to be ground, and they are not cleaned mechanically, as by brushing, tumbling or blasting, the burned-in oil deposit tends to load and clog the grinding wheel. The wheel efficiency is reduced, and checking of the ground workpieces may occur.

Some maintenance schedules provide for weekly cleaning of washing machines, particularly if the cleaning problem is a severe one. Spent and oil-laden solutions should be dumped and all sludge removed before making up new solutions. In time, the pumps wear and the spray nozzles become clogged and eroded. These matters require regular attention if efficient cleaning is expected. Brass fittings should not be used with alkaline cleaning solutions, which attack and corrode them. The two-stage type washer does a better job of cleaning than the single-stage, when the washing load is exceptionally heavy, and where the geometry of the parts favor oil retention.

Pyrometers and Thermocouples

Measurement and control of temperatures is the heart of heat-treating procedures. Accuracy must prevail at all times. Therefore, pyrometer equipment must be properly and regularly maintained. Many plants carry out this maintenance program on a monthly basis. The instruments are cleaned, oiled, adjusted and repaired where necessary. Thermocouples, on the other hand, are usually checked more frequently, once a week being very desirable if possible. In checking thermocouples, they may be removed from their position in

the furnace and be replaced with one that has been checked, later to be checked against standardized thermocouples at the checking station. However, this procedure checks only the thermocouple, but does not disclose if other parts of the temperature-measuring system are in error.

Use an Extra Port

For instance, a short circuit or loose connection may develop in the lead (extension) wires, or perhaps the pyrometer may be at fault. Replacement of the thermocouple with a calibrated one does not guarantee that the correct temperature is being measured. A satisfactory way to check furnace temperatures is to provide an additional port adjacent to the one into which the regular furnace thermocouple is placed. A calibrated thermocouple connected to a portable checking potentiometer is then inserted into the extra port. After allowing sufficient time to reach the temperature of the furnace, a reading is made and then compared with the reading of the furnace pyrometer.

If it is impossible to provide a second opening because of furnace construction, the check couple, connected to the checking potentiometer, may be introduced into the protection tube alongside the regular furnace couple, provided there is sufficient room. If not, the regular furnace couple may be withdrawn temporarily and the checking couple inserted in its place, connected however to the checking potentiometer. A somewhat quicker method, though not so accurate, is to use an optical pyrometer; however, the temperatures being measured should be at least above 1400 F.

From time to time, thermocouple-protection tubes should be withdrawn from the furnace for inspection of signs of general deterioration and failure. They should be placed open end down and tapped to remove accumulated dirt and scale. Thermocouples are not ordinarily affected by oxidizing atmospheres such as encountered in open-fired furnaces. Here, therefore, protection-tube failures are not a serious problem. But if thermocouples are exposed to reducing atmospheres (as used in carburizing, carbonitriding, carbon restoration and nitriding) their chemical composition will be altered and their calibration will change, resulting in error. Protection tubes used in atmospheres like these must be constantly watched for evidence of leakage into them. Certain salts and lead likewise attack thermocouples. So it is necessary in liquid-bath heat treating to guard against protection-tube leakage.

Several factors influence good performance, long life and freedom from excessive maintenance and repair of thermocouple-protection tubes. These are: (1) material or composition; (2) dimensional characteristics such as outer diameter, wall thickness and length; (3) operational position in furnace, whether vertical, horizontal or angular; (4) sensitivity to temperature change, and (5) thermal environment. For lowest over-all cost combined with freedom from maintenance and repairs, the composition of protection tubes must be reconciled with furnace environment. As a guide in this direction, Table 3 is presented.

Trouble sometimes arises from short circuiting of the thermocouple wire within the protection tube. The ceramic insulators may break and allow the wires to touch. Any contact of the wires between the hot and cold junctions of the wires will cause erroneous temperatures to be obtained. Hence, always keep the insulators in good condition. Also, lead-wire coverings should be maintained in good condition.

The current trend is to place recording temperature controllers or pyrometers near the furnaces rather than in a central control room. Installations of this kind requires more maintenance because the instruments in general operate under less favorable conditions due to heat, fumes, dust and vibrations which are usually encountered in heat-treating departments. If instruments are placed alongside the furnaces, sufficient insulation

Table 3—RECOMMENDED APPLICATIONS FOR COMMONLY AVAILABLE THERMOCOUPLE PROTECTION TUBES

MATERIAL or COMPOSITION	CONSTRUCTION	RECOMMENDED APPLICATIONS
77% Ni-15% Cr Inconel Nickel 62% Ni-13% Cr	Drawn Drawn Cast	General furnace use to 2100 F, oxidizing or reducing conditions, except sulfurous atmosphere
25% Cr-20% Ni Type 310 35% Ni-18¼% Cr 25% Cr-12% Ni Type 309 27% Cr	Welded Cast Drawn Drawn	General furnace use to 2100 F, oxidizing or reducing conditions, including sulfurous atmospheres
27% Cr	Drilled	Lead, cyanide, and salt to 2100 F
Inconel 35% Ni-15% Cr Type 330	Drawn Drawn	Cyanide, and neutral salts, 2100 F
Cast iron	Cast	Aluminum and die-cast metals
Steel seamless Wrought iron	Drawn Pipe	Low-temperature applications; tin, zinc, oil baths, etc 1000 F max.
Porcelain		High temperatures beyond range of metal tubes to 2500 F
Silicon carbide		Galvanizing, aluminum and protection for porcelain tubes to 2500 F

Courtesy: Arklay S Richards Co, Inc.

should be provided to prevent them from becoming too hot from the furnace walls. Likewise if they are attached to, or supported by, channels or frames, the supports should be insulated with rubber separators to eliminate vibration which is detrimental to good instrument performance and also causes extra maintenance.

Oil Quenching Systems

Quenching tanks, jigs, presses, coolers, settling and storage tanks and related appurtenances may be considered as part of the oil-quenching system. How well it is kept in proper working order is directly reflected in the quality and trouble-free production of hardened workpieces. There is constant breakdown of oil into carbon and insoluble residues or sludge. Gradually these solids accumulate to harmful proportions if not removed. The harm caused is not so much a radical change in the quenching rate of the oil but rather interference with proper working of the equipment through which the oil flows. If heavy concentrations are permitted to accumulate, trouble arises from several sources. Sprays clog, filtering screens become covered over, pumps wear, quenching presses perform erratically and heat exchangers function improperly.

There are several ways to combat accumulation of solids in the quenching-oil system. However, maintenance still is required. Filters and centrifuges usually require attention, such as daily cleanings. Settling tanks eventually have to be emptied for removal of accumulated solids. Quenching tanks, presses, jigs and machines must be cleaned. If these cleanings are made without plan, the chances are that the best quenching job is not being done.

It is best to clean all accessible facilities such as quenching tanks, sprays, headers, screens and presses weekly, or at whatever time interval seems appropriate. If constant filtration or centrifuging facilities are not available, arrangements with outside companies specializing in this work should be made for semi-yearly treatment. At the same time settling tanks and storage tanks also should be cleaned. Some plants rent railroad tank cars for storage of oil, thereby permitting drainage of the entire system for a thorough cleaning and removal of the accumulated solids from the various facilities.

Hoods and Ductwork

The trend is to make heat-treating departments a better place to work. Many are now well illuminated and maintained in an orderly fashion. Widespread use is made of sheet-metal hoods and ductwork to carry off heat, fumes, smoke and flame. To obtain positive evacuation to the outside of the building, it is nearly always necessary to install a suction fan in the ductwork to prevent outside high-wind conditions from blowing the products back down the stack. Under certain conditions hoods, suction fans and stacks become a fire hazard if care is not taken to keep them clean, especially when oil vapors or soot-bearing gases are being evacuated or when they are employed to convey flames and hot gases away when furnace doors are opened. Hoods and ductwork should be brushed clean, as often as accumulations of combustible foreign matter become hazardous. Blades and housings of suction fans likewise should be cleaned.

Furnace Combustion Systems

Combustion systems are designed for the controlled burning of fuel with air. When the installation is new and properly adjusted, maintenance of the system is not much of a problem. However, in heat-treating environments, it does not take very long for trouble to develop if the combustion equipment is not properly cared for.

In addition to the usual pyrometers for controlling temperatures, combustion systems may employ any one of several appurtenances: burner-air blowers, control valves, regulators, zero governors, burners, mixers, pilots, safety shut-off valves, filters, strainers, electric motors and pressure gages. All these components require attention from time to time to keep them in good working order. Good housekeeping around furnaces is well repaid in trouble-free operation. Accumulations of shop dirt and oil vapors tend to blanket furnace appurtenances in time and thus prevent their proper operation. One way of circumventing this is to vacuum clean the exterior of furnaces, the piping systems and other appurtenances during shutdown periods for repairs.

At times, proper response of the material being heat treated is not obtained. The difficulty may manifest itself in many ways. For instance, a heat-treating furnace may not be heating as rapidly as it should, although supposedly there is no apparent change in the combustion system. Or, perhaps, a carburizing furnace may not be producing the desired case depth for its regular cycle of operation. Perhaps a carrier-gas generator is producing an inferior gas composition for no apparent reason. The first thought naturally is to suspect the material being treated, or perhaps the thermocouple, the temperature-measuring system or the fuel composition.

Looked at Too Late

About the last thing usually done by those responsible for correcting the trouble is to examine the various combustion-system appurtenances. None of this equipment will continue to operate properly in the average heat-treat department unless it receives proper attention. Dirt, vapors and heat cause the most trouble.

Combustion systems for heat-treating furnaces may employ any of the following types of burners: (1) gas burners, (2) oil burners, (3) gas-oil conversion burners, and (4) gas-oil burners. Gas-burner equipment can be divided into two specific types: (1) atmospheric, low-pressure burners and (2) blast or pressure burners. Oil burners are classified in the North American Combustion Handbook thus:

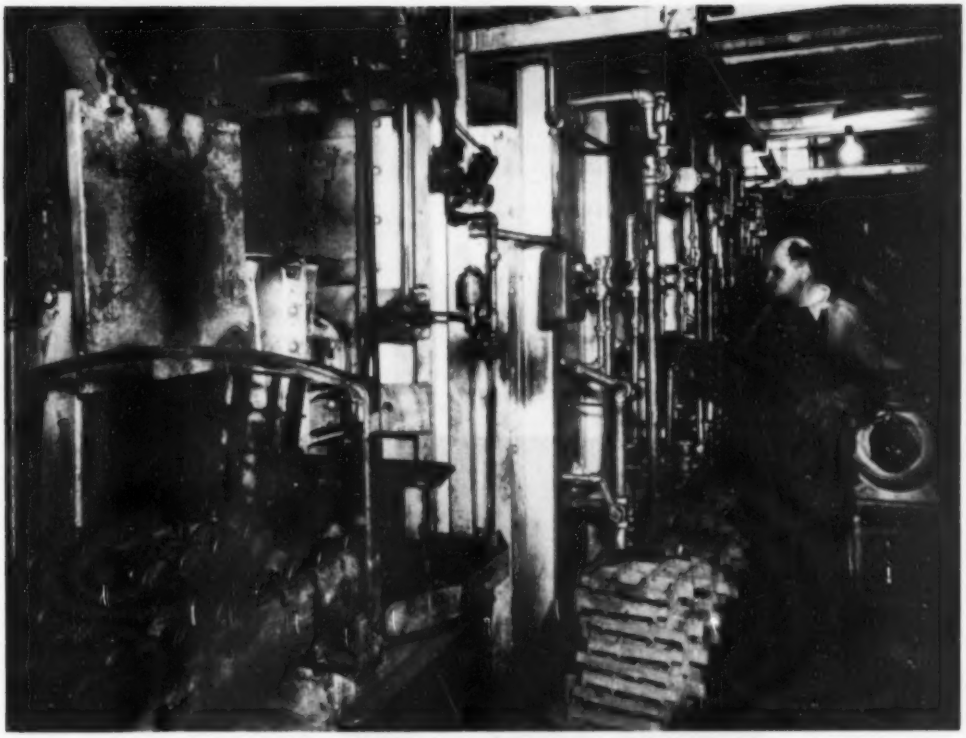
Low-pressure air atomizing type

High-pressure air or steam atomizing type

Oil-pressure atomizing type

Centrifugal atomizing (rotary) burners

Even though burners vary widely in design, type and combustion characteristics, the basic principles for keeping them operating satis-



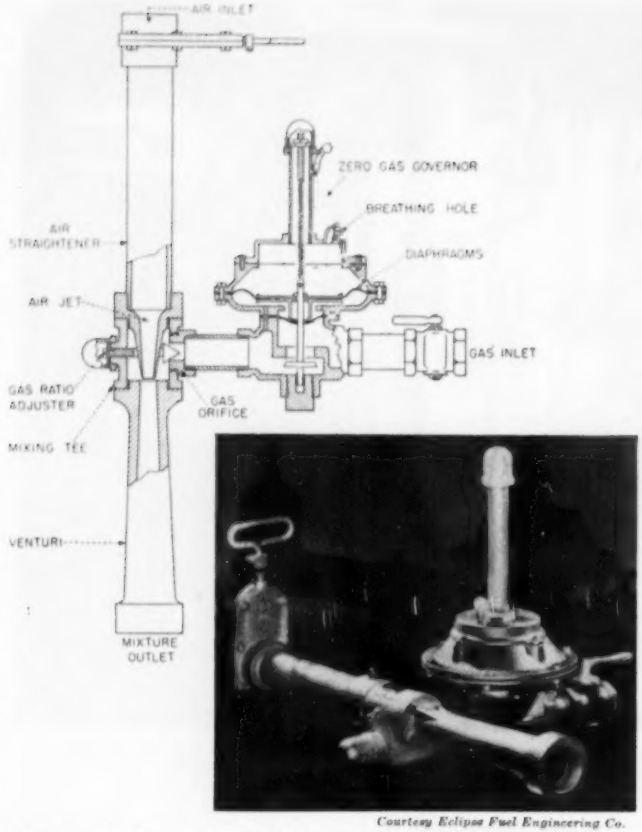
Vacuum cleaning removes accumulations of shop dirt and oil vapors that prevent proper operation of furnace appurtenances. Clean the furnace exterior and piping too

factorily are much alike. Either low-pressure or high-pressure gas burners which entrain the primary air for combustion eventually perform improperly if the air shutters become clogged from shop dust and fumes. In like manner, dirt accumulations occurring in the venturi throat of mixers reduce the mixture velocity as well as throat area and thus interfere with proper burner performance. So do clogged air and gas spuds and burner nozzles. Their areas must be kept constant, because for proper burner efficiency a definite area relationship exists between these openings and the areas of the inspirator mixers.

Burner tiles, referred to also as refractory blocks or tuyeres, are not to be considered indestructible. In most applications, they function for years as efficient combustion chambers giving good heat transmission. However, if they become eroded and deteriorated to the point where their physical shape is appreciably altered from their original dimensions as a result of improper burner adjustment or poor alignment, or from one unseen stoppage or obstruction that prevents proper combustion of the fuel mixture, burners will not operate as efficiently as they should.

With gas-oil conversion burners, or any of the other type burners employing oil as a fuel, clogging of the burner nozzles is almost a certainty if dripping of the oil at the nozzles takes place. The oil cracks into carbon (soot) and hydrogen, resulting in free carbon deposition. When utilizing oil-burning equipment, it is important to maintain the fuel lines as free as possible from foreign matter like water, air and sediment. Water and air in the oil lines, and water in the air lines, cause irregular burning and hence poor control. Sediment, which is also harmful, lodges in the spray nozzles, valves, solenoids and other pieces of the combustion system. Strainers, therefore, should always be installed upstream from the control equipment.

Regulators for controlling air, gas or oil pressures require maintenance from time to time. There are many different designs of regulators used for widely different purposes, but in general the maintenance for all of them pretty well follows the same pattern. When the desired pressures and gas flows cannot be maintained, usually the diaphragm has deteriorated and requires replacement or, in all probability, the compression or tension characteristics of the balancing spring have changed, thus requiring an adjustment. Another source of trouble is dirt deposition on the valve faces which prevents obtaining a positive seal.



Courtesy Eclipse Fuel Engineering Co.

Low-pressure, air-gas proportional mixers are precision mechanisms. Foreign matter must be kept out of pipe lines leading to it, and breather hole must be kept open, if the device is to function properly

An accompanying illustration shows as low-pressure, air-gas proportional mixer. The sketch reveals the working details of a typical zero gas regulator or governor with its spring and diaphragms, a typical mixer showing the venturi sleeve, and a gas-ratio adjuster. These details provide a clearer understanding of the necessity for keeping foreign matter from becoming entrained in the pipe lines. Care also must be taken to keep the port or breathing hole to the atmosphere on zero governors open at all times, otherwise the governor will not function properly.

Shut-off valves should receive inspection at periodic intervals to assure proper performance, especially in emergencies. Both manual and safety-type shut-off valves should be actuated from time to time to prevent seizure from non-usage. Butterfly-type valves should be checked for linkage wear to guarantee desired operation of opening and closing. Dirt on the seat of butterfly and also V-port type valves causes trouble by interfering with complete closing.

Pilots, whether of the spark plug or gas-burning type, should be kept in good operating order because their purpose is to ignite the fuel-air mixture coming through the burners. The general run of trouble with gas-burning pilots is burning away of the ceramic tips and accumulation of dirt in the inspirators, which results in not obtaining the correct air-gas mixture for positive combustion. The spark-plug pilot requires cleaning and proper gap setting, if good performance is to be consistently obtained.

Air blowers and boosters are important mechanisms in combustion equipment. If the bearings are allowed to become badly worn, the rotors become unbalanced. Unbalancing and decreased blower efficiency also result from dirt accumulations on the impeller blades. To avoid this trouble, filters should be installed on blowers. Regular cleaning of filters, however, is necessary, since clogging of the filter decreases the air intake which in turn results in improper burner performance.

Blower failures on controlled-atmosphere furnaces like large continuous gas carburizers, bright annealers, clean hardening and carbonitriding furnaces pose a serious problem, because the heating of the workpieces becomes interrupted. If repairs to the blower cannot be made quickly, work spoilage frequently threatens, because the atmosphere gas must be removed from the furnace before explosion temperatures are reached as the furnace cools down. An inexpensive way of avoiding such a circumstance is to provide a standby blower connected to the various furnaces where blower failures are intolerable.

In conclusion, freedom from breakdowns and improper functioning of heat-treating equipment is in direct proportion to the thoroughness and effectiveness of the maintenance and care it receives. Avoidance of an adequate maintenance program is not only costly in the long run but injurious to equipment and sustained production.

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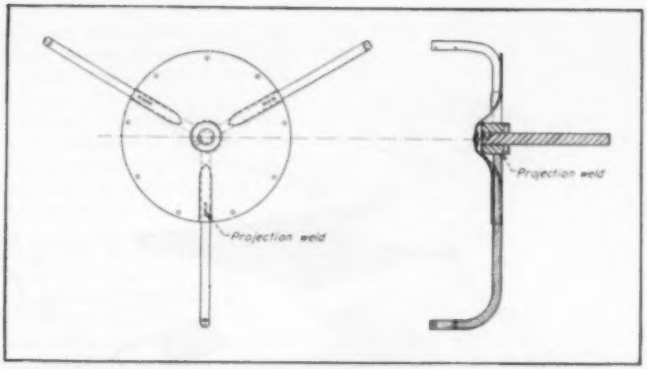
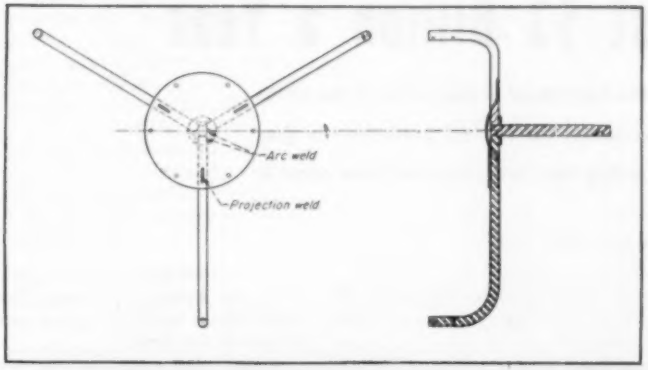


ORIGINAL DESIGN of spider for clothes-drying machine had three arms projection welded to machined hub which was keyed to control shaft. Dished stamping, embossed to fit over arms and cover hub, was projection welded to each arm to provide smooth working surface. Removable button was required in top of stamping to give access to key

CHANGE SPIDER, SAVE PART

Changing from projection welding to arcwelding permits simpler design of spider for home-laundry clothes dryer and eliminates machined part

BY G C FARRINGTON,
Welding Engineer, WHIRLPOOL CORP

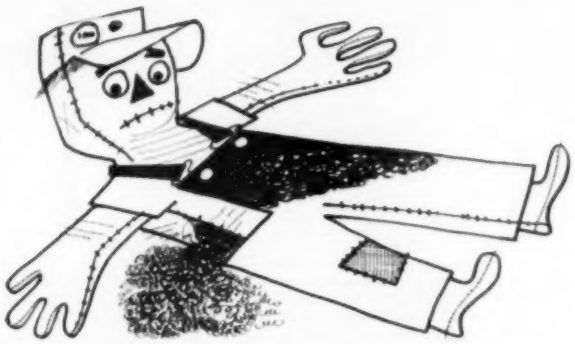


REDESIGNED SPIDER has arms arcwelded to shaft and to a small washer. Hub is eliminated, dished stamping is smaller, and removable button is not required. Keyway is placed at lower end of shaft for attachment of driving pulley. Savings in machining time alone amount to more than 60c per assembly

ARCWELDING FIXTURE positions shaft, washer, and three spider arms, and insures squareness of assembly. Production rate is 45 pieces per hr, including loading and unloading time

PROJECTION WELDING of stamped cover to arms is the same as on the earlier design, but cover is smaller so there is some saving in material. Cost of making and inserting button is also saved

100,000 killed
millions injured
that's why...



Off-The-Job Accidents Cost $3 Billion a Year

If one of your employees falls in the bathtub or breaks a leg on the cellar stairs, it may not be your responsibility, but his lost production is your loss. Here's a thought-provoking article that tells you what to do about it

BY ARTHUR S JOHNSON, INSTITUTE FOR SAFER LIVING

WITHIN the plant, American management, through its safety engineers and supervisors, by slogans, posters, and contests, in factories and offices, constantly pounds home the lessons of Safety First.

But what about the other hours? What about the hours away from the plant? Those are the danger hours. Those are the hours in which three employees are killed or injured for every one involved in an in-plant accident. That isn't a guess; it is based on the results of a survey of nearly 300 major companies made by the Institute for Safer Living of the American Mutual Liability Insurance Co.

Want a for-instance? B F Goodrich Co says that in 6 years, covering 196 million man-hr in one plant, it has had no industrial fatalities, but 22 employees have been killed in off-the-job accidents —18 of them in traffic. Seven of those were highly skilled workers, seven others were semiskilled. Bakelite Div, Union Carbide & Carbon Corp, has records to show that, over the past 5 years, its employees have sustained 2½ to 3½ off-the-job accidents for every plant accident.

Even more startling is General Motors' report that, over a 12-mo period, for each 1000 employees, 22 lost time because of nonoccupational accidents and only 4 lost time through occupational ones. Yet, GM's record is only one-half that of the national average. Figures published by the National Safety Council show that for all workers, off-the-job accidents run to 44 per 1000 per year.

And that isn't all the story. A substantial percentage of plant accidents are directly attributable to accidents which have already occurred to members of the victim's family in the home or on the highway. A punch-press operator, for example, lost two fingers through failure to strap on the safety wristlet. Investigation showed that her husband had been injured in an automobile accident some time earlier and was developing into a mental case. Her explanation of the press accident was: "I was thinking about my husband at home. The next thing I knew, my hand was caught in the press."

A rigger lost a leg when he was pinned between a furnace door and a large steel mandrel. The crane operator called to him to get out of the way, because he felt the door would swing when he took the strain on the load. The rigger told him to mind his own business and get on with the job. Result—one leg lost. Later, the victim admitted that he was irritable and out-of-sorts from worry over the condition of his wife who had been seriously injured by falling down the stairs at home. He said, "I am sure that if I had not been worried about her accident, I would have followed the advice of my crane operator and stood clear."

A laborer was crushed to death by a 500-lb boulder. Fellow workers reported that he appeared to be paying no attention to what was going on at the time. Investigation disclosed that, the previous day, he had been driving a car in which his wife, two daughters and two nieces

had been seriously injured. As a result, he was mentally distraught.

These are but a few of the many accidents that happen every day. Insurance - company reports disclose thousands of cases in which the disturbing effect of trouble at home has had a strong influence on the factory mishap. Worry over an injury that has occurred; worry as to how the bills will be paid; worry as to who will take care of the children; worry as to possible permanent disability; all these are mental distractions that contribute to on-the-job accidents and hamper individual production.

Off-the-job accidents have their causes, too. How many men starting out for work after "a few words with the wife" decide to take it out on other drivers? Thoroughly irritated, they cut out of line, or refuse the right of way. And they, or an innocent fellow worker, wind up in the hospital or the morgue. Or, leaving work after an argument with the foreman, express their indignation by stamping on the accelerator, with equally disastrous results.

Whose Responsibility?

Some employers feel that such matters are not their responsibility; that what a man does on his own time is his own affair. But many are now beginning to realize that involuntary absenteeism — caused by off-the-job accidents—is costing industry the fantastic sum of $3 1/3 billion a year, and that safety *off* the job is just as important to national economy as safety *on* the job. One company, employing 3000 people, analyzed its group accident and health claims and discovered that off-the-job accidents accounted for 1044 lost days in a year. And this represented only those cases where the lost-time period was in excess of 14 days. There were no records for the shorter periods.

What are we going to do about it? And why, with a few notable exceptions, is nothing being done about it? A recent study among 260 leading companies reveals that, as a whole, management is aware of the hazard. Yet, only 36% were able to say that they were doing "something" about it, and there was little evidence of any fully organized, off-the-job safety program. More than half agreed that off-the-job safety activity would have a most beneficial effect in reducing lost working time and improving working morale. And about as many said that such a program would be established in their plants if a sound, workable, employee-education plan, including necessary instruction aids, were available. An additional one-third said that such a plan might be adopted "if it didn't take too much time from work," or "if it didn't arouse employee resentment."

The chief obstacles appear to be that there is a lack of opportunity for control and for applying safety engineering techniques which gives the problem an aura of intangibleness. There is also a general belief that employees and members of their families would resent recommendations which appeared to be an intrusion into the home. Accordingly, management tends to throw up its hands whenever it thinks of tackling the job. And even if these mental obstacles are overcome, a well-disposed safety director runs into the blank wall of unavailability of a well-designed, well-rounded, tested, long-range program. Thus, industry as a whole has, up to this point, done but little about it.

The Money Angle

But let's look at the matter from a dollar-and-cents viewpoint. There is currently abroad a movement to spread the cost of recovery from illness and to restore accident victims to gainful occupations through the principles of insurance. Because compensation for lost-time accidents and the costs of hospital and medical care add up to such tremendous amounts, the broad subject of accident and health insurance has become a major political issue. However, it must be remembered that compensation is no substitute for preventing accidents. While there is much to be said for the incentive feature in the merit rating of workmen's compensation insurance, as well as in the private purchase of group accident and health insurance, there is considerably more incentive for employer-sponsored and directed accident prevention activity than the question of cost reductions. Basically, accident prevention to save life and avoid suffering needs no incentive.

For many years, management has striven to reduce its workmen's insurance compensation rates by controlling its losses. It is not uncommon for a business to achieve rate credits of 35 to 40% through result-getting, on-the-job safety. In most cases, the same cost-reducing effect can be achieved on group-insurance premiums. Considering that, on the average, group - insurance premiums run higher than workmen's compensation costs, cost-conscious management should have a strong interest in keeping group-insurance losses under the best possible control. Clearly, one important factor can be the reduction of accidents. Looking ahead several years, it is a reasonable possibility that group insurance may have the same compulsory aspect, nation wide, as workmen's compensation does today. Already, New York, New Jersey, Rhode Island, and California have made this coverage compulsory, and several other states are considering it. Many managements are aware of this and are now wondering what they can do about controlling off-the-job accidents.

What to Do

Specifically, there are seven premises upon which an off-the-job safety program should be founded:

1. The purpose and plan must be

an objective of management, as compared to the casual conduct that now marks many safety programs. It must not only have the blessing and approval of top management, it must be a part of management's scheme of things.

2. The program must have control and it must receive intelligent and experienced direction. Because there are many dangers involved through invasion of the sanctity and privacy of the home, management may choose to act only in an advisory capacity by providing inspiration, suggestions, personnel, materials, and funds. In such cases, best results may be achieved by having an employee safety committee conduct the program. Where management elects to control the program, it can be an integral part of the in-plant safety authority, with responsibility assigned to the safety director, safety committee, and members of the foremen group. Whatever method may be followed, it must never be forgotten that participation in such a program is always voluntary.

3. The program must have continuity and regularity of effort. Surveys indicate that too many plants now doing something to prevent off-the-job accidents are making only sporadic efforts, rather than as a part of a continuous plan.

4. The program must aim to create employee interest. Safety is not news. Only accidents make the front page. Yet it can be made interesting, in itself, and because of the benefits it can produce. This is the greatest challenge to the employer's ingenuity.

5. The program must provide a never-ending supply of show-how and know-how. "Don't get hurt" is a waste of breath. "Do it this way" is a good beginning.

6. The program must employ every possible means of interesting the family group in doing the things that will make the home safer for living. Then perhaps the family members will strive to live safer for the home.

7. The program must provide means for orderly investigation of home accidents. This is the means by which knowledge is extracted from a lot of otherwise useless information. Safety programs must not be theoretical—they must be realistic, based on fact, and apply to each plant's specific problem. Accurate records are essential.

How to Do It

To achieve these objectives, the Institute has devised a complete program which can be applied entire, or in part, to promote the successful operation of an off-the-job safety program.

1. To give the program official standing and make known the company's interest, a suggested letter has been designed to be sent to each family, at home, stating the conditions which make such a program important, and outlining the plans designed to help the family live safer lives.

2. To arouse interest in safer home living, a special safety meeting, audience - participation quiz show has been developed, devoted entirely to off-the-job safety. It is designed to show that safety must be a matter of knowing how, and that safety can be interesting.

3. A special home safety check has been designed to help the family make the home a safe place to live in.

4. A special safety show-how publication is distributed twice a year. With words and pictures it shows practices that make for safer living, tells how to handle emergencies, and provides first-aid and health information.

5. To provide more detailed information on specific hazards, individual subjects are treated in special booklets. These include: Ladders, Their Safe Use; Fire at Night and How to Prevent its Becoming a Tragedy; Splinters and Infections; and Dangers of Unsupervised Use of Antibiotics.

6. To maintain on-the-job interest in the off-the-job safety program, home and highway safety posters have been designed to be posted on plant bulletin boards.

7. Home and highway safety material has been prepared for inclusion in the house magazine. Considerable space should be devoted to the over-all program, and the magazine should continually present show-how information.

8. Incentives maintain interest. There should be inter-group competition with approprite recognition going to the group with the best off-the-job safety record. To keep the whole family interested, the plan provides for a scholarship essay competition among employees' children on the subject, "What we have done to make our home safer."

9. Careful, orderly investigation of accidents is a basic part of the program. A special accident-investigation form has been prepared to serve the important purpose of disclosing sources and causes.

Where to Get It

Most of this material, in one form or another, is readily available from the National Safety Council, several of the life and casualty insurance companies and, as a coordinated whole, organized in program form, from American Mutual Liability Insurance Co.

Naturally, any organization interested in doing something about off-the-job safety is interested in the cost. Estimates for furnishing the material to support such a program vary greatly, depending on source, number of employees, and frequency of issue of material. However, tests demonstrate that a practical, result-getting program can be supplied within a budget of $1.00 per family per year.

The whole objective of the program is simple — to make living safer for people and people safer for living. When management will pave the way for such a program, and employees do all in their power to cooperate to achieve such a result, the benefits are immeasurable.

HOW TO UNDERSTAND BRASS

BY SAMUEL STORCHHEIM, SENIOR METALLURGICAL ENGINEER,
SYLVANIA ELECTRIC PRODUCTS INC, BAYSIDE, N Y

All too frequently, metallurgy is presented in such a way that it confuses the man with no special metallurgical training. Terms and phrases are included which are complete Greek to the busy reader who hasn't the time to pore through literature for definitions. We asked Mr Storchheim to present the basic metallurgy of brass alloys so any shopman can understand these alloys and why they do what they do

FUNDAMENTALLY, brass alloys[1] are made up of varying percentages of copper (Cu) and zinc (Zn) with possible small additions of other metals. The properties as well as the designations of these alloys are dependent, primarily, upon the amount of zinc present. For instance, brass containing less than 17% of Zn is termed *red brass*, while brass containing more than this percentage is known as *yellow brass*. Several of the more common or well-known brasses are:

% CU	% ZN	DESIGNATION
85	15	rich low brass
80	20	low brass
70	30	cartridge brass
66	34	high brass
60	40	muntz metal

Names of alloyed brasses can be very confusing and misleading. Brasses originally called "german silver" are now known as "nickel silver", primarily because of their white color. They are composed of Cu, Zn and Ni (nickel) and do not contain any silver. In a like manner, the so-called "manganese bronze" is basically Cu-Zn alloy with small additions of Al (aluminum), Fe (iron), Mn (manganese), Ni (nickel) and Sn (tin). These metals are added to improve the mechanical properties or corrosion resistance of the alloy. The American Society for Testing Materials classifies this alloy as "high-strength brass." Two other improperly termed brass alloys are "commercial bronze", which is a plain red brass, and "architectural bronze" which is simply a leaded brass containing some lead.

One may ask, "Why the varying percentages of Zn?" The answer is quite simple—different mechanical as well as other properties are obtained with the addition not only of varying percentages of Zn but also of other metals. Here are the most basic metallurgical facts behind this statement:

a. In varying the amount of Zn up to 38%, no change is observed in the appearance, under the microscope, of the alloy structure. What is seen is termed the alpha* brass constituent, Fig. 1. This constituent or phase is completely molten for a 90% Cu-10% Zn alloy at about 1900 F. For an alloy containing 30% Zn, it is molten at about 1750 F, the decrease in melting point being almost directly related to the amount of Zn added. The alpha phase is known to be soft, ductile, and tough; toughness and ductility are a maximum at about 30% Zn. These alpha alloys are easily deformed at room temperature; ie, they are readily cold-worked.

b. Increasing additions of Zn to Cu from 38.0 to 46.5% cause a change to occur in the alloy structure observed under the microscope. As the Zn content increases, more and more of a new constituent comes into view. This new phase is termed beta brass and is intimately mixed in with the alpha brass, Fig. 2. It is different from the alpha phase in that it contains not only more Zn, but also a critical amount more which causes a change to occur in the arrangement of the atoms of the phase. When the addition of Zn is in the range of 46.5 to 49.0%, the entire structure of the alloy remains as beta brass; ie, no alpha brass is present, Fig. 3.

[1] An alloy is the combination of two or more metals

* "Alpha" is merely the first letter of the Greek alphabet, which is commonly used to name some structure of an alloy. In this case it is alpha brass. For iron it would be alpha iron, etc.

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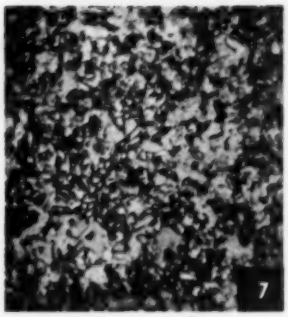
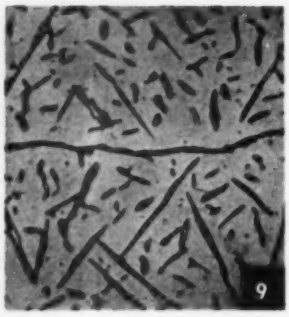


Completion of recrystallization (X75) Same as the specimen of Fig. 5, except it was reheated for 30 minutes at 750 F. Recrystallization is now completed. No old deformed areas are visible

Grain growth following recrystallization (X75) This specimen was heated at 1200 F for 30 minutes. Note how large the grains have grown, also the many parallel-sided areas; ie, twins



Typical precipitated brass alloy (X50) This photomicrograph very clearly illustrates the precipitation of platelets of one phase from another phase. Note the regularity of the platelet lineup. This type of structure is referred to as a Widmanstätten pattern

What occurs during this homogenization treatment is that the Cu and Zn atoms move away from their high concentration points to low-concentration areas; ie, the atoms diffuse. The net result is a levelling out of the high-concentration areas to an average value.

D. Heating alpha or beta brass alloys below their melting points causes the grains of these alloys to grow. In as-cast metal, the process is generally fairly slow. However, in cold-worked structure, Fig. 5, the reaction to increasing temperatures is quite different. It is:

1. At relatively low temperatures, no noticeable change occurs in microstructure; however, the metal is relieved of the residual stresses imparted to it by cold working. This effect is known as "recovery." For alpha brasses, hardness and strength increase slightly during this treatment.

2. When the temperature is increased to about 570 F, the deformed grains of the structure start to reform (recrystallize) into new, small grains of a fairly uniform shape, Fig. 6. At 750 F, this process, recrystallization, continues until the entire deformed structure has been transformed to recrystallized grains, Fig. 7. Recrystallization causes the alloy to be softened.

3. Heating the cold-worked structure to 1200 F or higher causes grain growth to occur; ie, causes the recrystallized grains to grow in size, Fig. 8. (The bond sections within the grains of Fig. 8 exhibiting straight parallel sides are termed "turins" and are common to alpha brass.) Grain growth effects a further softening of the alloy. The process of either recrystallization or grain growth or both is commonly termed "annealing." From the above discussion, it can be seen that annealing alpha or beta brass is the process of changing a cold-worked distorted and stressed metal back into a strain-free, non-distorted structure. (This definition holds for all other metals and alloys.)

Alloys Consisting of Alpha plus Beta – Brass alloys consisting of a mixture of alpha and beta phases respond to the heat treatments described in the previous section. In addition it is possible to vary the two phases in their distribution and amounts present. This can be done by properly subjecting the alloy to different temperatures, times at temperature and rates of cool from these temperatures. As an example of what can happen during heat treatment, let an alloy containing 60% Cu and 40% Zn, muntz metal, be used for the illustration.

A. Let it be assumed that the alloy is molten and is being allowed to slowly cool in a furnace. At a temperature of about 1670 F, parts of the liquid alloy start to solidify into crystals, these first crystals being grains of beta phase. As cooling continues, the grains grow as the liquid alloy starts solidifying on them. Eventually, these grains impinge one upon the other, the location of their meeting places being known as grain boundaries. The last bit of liquid metal solidifies in the vicinity of and at the grain boundaries. Thus, the alloy is a solid mass of beta grains at about 1630 F.

There is no change in the amount of beta phase as the temperature drops until a temperature of about 1430 F is reached. At this point, alpha phase starts to form at beta grain boundaries and within the beta grains; ie, alpha is precipitating from beta. (This is very similar to the familiar phenomenon of heating water, dissolving sugar in it, then cooling the water until crystals of sugar come out of the solution in the form of "rock candy.") Continued cooling of the brass alloy to room temperature causes more alpha to appear and the previously precipitated alpha particles to grow in size. A maximum of about 50-60% of the final structure will be alpha phase, when the brass has cooled to room temperature.

B. A more rapid cooling, an air cool, of the alloy from the temperature range where only beta exists will not allow the formation of as much alpha as previously formed.

C. By an even more rapid cooling (water

quench) of the alloy from the beta range, it is possible to suppress almost completely the beta-to-alpha transformation; ie, to allow practically no alpha to appear. The structure will be very similar to that of Fig. 3.

D. In the condition of C (above), the alloy is not in equilibrium; ie, the alpha is in solution and wants to come out. At room temperature, the alpha cannot come out; however, should the alloy be subjected to a temperature of about 840 F, alpha will come out, precipitate, as plateless from the beta, Fig. 9. The higher the temperature used to precipitate the alpha, the heavier the plates will be. Eventually, the temperature used will not cause plates to appear but rather, a film of alpha about the beta grains with some alpha spheroids distributed throughout the grains. With increasing amounts of ejected alpha, the alloy becomes softer.

E. It is possible, by low-enough temperature treatment of the unstable beta condition, to have the alpha come out as very fine particles, fairly uniformly distributed throughout the structure. This process causes the alloy to become hard and brittle and the alloy is then referred to as being in the precipitation hardened condition.

F. If the slow-cooled alloy discussed in A, above, is heated to successively higher temperatures and quenched, less and less alpha will be seen in the structure. Any alpha originally present at the grain boundaries will be found to have broken up, while long alpha particles within the grains will have started to round off into spheres; ie, spheroidized.

Mechanical Properties

The mechanical properties of brass alloys can best be described by means of graphs. Figs. 10 and 11 show the effects varying percentages of Zn have upon the properties of brass. In addition, Figs. 12

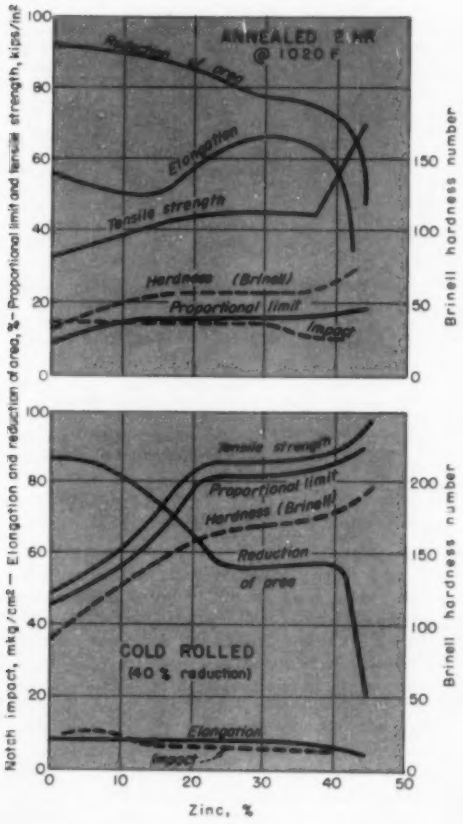

ANNEALED 2 HR @ 1020 F
Reduction of area
Elongation
Tensile strength
Hardness (Brinell)
Proportional limit
Impact
COLD ROLLED (40 % reduction)
Notch impact, mkg/cm² — Elongation and reduction of area, % — Proportional limit and tensile strength, kips/in²
Brinell hardness number
Zinc, %

Fig. 10 — **Tensile properties, impact value and hardness for various brasses.** Notch impact is in m kg/cm², elongation and reduction of area in %, proportional limit and tensile strength in kips/in.²

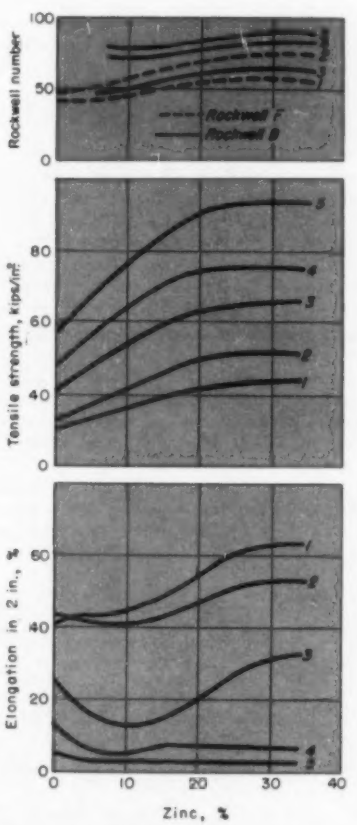
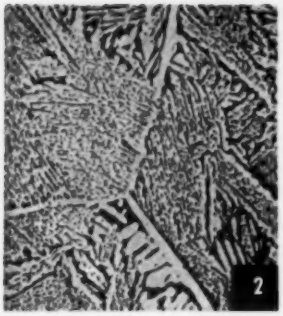
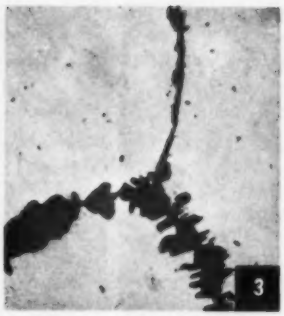


Fig. 11 — **Tensile properties and hardness of 0.04-in. copper-zinc alloy sheet** in various forms. Dotted lines are Rockwell F scale, solid lines Rockwell B scale. Curves 1 are soft-annealed stock; 2, light anneal; 3, rolled (21% reduction); 4, rolled (37% reduction); 5, rolled (60% reduction)

All alpha-brass structure magnified 50 times. The differently shaded areas are grains actually identical in composition and and structure. Variation in shading is caused by inclination at various angles and resulting variation in reflecting light



Alpha-plus-beta brass structure magnified 50 times. Alpha shows up as white, while beta is black. Note how uniformly and intimately the two phases are mixed



Beta-brass structure (X50) This structure shows the beta as white and some alpha, which is present at the grain boundaries, as dark. The alloy used for this picture actually had a composition which allowed a slight amount of alpha to be present

Figures 1 to 9 used by permission from "Structures and Properties of Alloys," by Brick and Phillips. Copyright 1949 by McGraw-Hill Book Company, Inc.

Beta brass containing 40% Zn melts at about 1670 F, which is 80 F lower than the melting point of a 30%-Zn alpha brass alloy. This comes about because more of the lower-melting-point Zn (787 F), has been added to the higher-melting-point Cu (1981 F). Zn in effect is "diluting" the Cu, and thus lowering its melting point. Upon very slow cooling or annealing* the grains of beta brass grow to a large size with little mutual cohesion. Beta alloys are likely to fracture under shock unless part of the Zn is replaced by other metals, primarily aluminum and manganese. Beta alloys are not easily cold-worked, but can readily be deformed at an elevated temperature: ie, can be hot worked. Beta phase is harder and more brittle than alpha phase.

c. Additions of Zn over 49.0% produce new phases; ie, new atomic arrangements of the Zn and Cu atoms, which are so brittle they make the resultant alloys of no commercial value.

d. As mentioned before, other metals are added in small quantities to Cu-Zn alloys. These various addition metals have specific effects upon the resultant Cu-Zn alloy properties. They are added individually or in combinations for these reasons:

ADDITIONAL METAL	EFFECT
Tin (Sn)	Increases corrosion resistance of alpha and alpha plus beta brasses. Two particularly well-known brasses of this type are "admiralty metal" (70% Cu, 29% Zn, 1% Sn) and "naval brass" (60% Cu, 39.25% Zn, 0.75% Sn).
Iron (Fe)	Refines grain size and increases strength of the alloy. In addition, it toughens the alloy and when added up to 2% it offers considerable wear resistance.
Manganese (Mn)	Increases incorrodibility, is used to clean embrittling oxygen compounds out of the alloy when it is in the molten condition; ie, deoxidizes the melt, keeps grain size small; effects a more mixed arrangement of alpha plus beta phases and, as discussed above, insures better cohesion between neighboring grains, thus increasing strength and ductility.
Aluminum (Al)	Deoxidizes the melt and replaces Zn. In the latter capacity, it increases ductility and extends the range of temperature in which liability to fracture under stress can occur.
Nickel (Ni)	Toughens the alloy and increases its ductility. Under certain conditions in a highly alloyed brass, it can cause a coarsening effect of the alloy into local patches which are sources of weakness.
Silicon (Si)	Used as a deoxidizing agent.
Lead (Pb)	Used as an aid for better machinability.

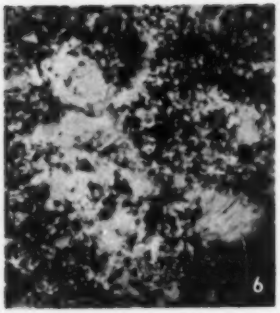
All of the above addition metals, with the exception of lead, cannot be found under the microscope. They are taken into solution, ie, absorbed by the Cu and Zn alloy, much as salt is absorbed by water. Lead, insoluble in brass, is seen under the microscope as discrete (separate) particles.

e. A very interesting property of addition metals is that, besides imparting the above effects, they can influence the brass microstructure; ie, the structure seen under the microscope. These elements supplement the normal effect of Zn and act as if varying equivalent amounts of Zn have been added to the alloy. For example, the addition of 1.0% of Al acts as if 6% of Zn has been added to the alloy. The following is a list of metals and their Zn equivalents:

*Annealing is a term generally implying that a cold-worked alloy has been heated to a high temperature for a period of time and has then been slowly cooled. This process softens the alloy for further cold work by a combination of relieving stresses set up in the metal by cold working, and causing the grains of the metal to recover from their deformed condition. If held at temperature long enough, the grains not only revert to their original shape but also grow in size, the largest ones devouring the smaller ones as the process continues. The grains themselves are individual crystals composed of the phases present in the alloy. When cold worked, they are broken up into smaller pieces as well as deformed and twisted out of shape. If cold work is continued without annealing, then the alloy will eventually rupture during the cold-working process.

Typical structure of an As-Cast Alloy (X50) The structure is composed of tree-like growths (dendrites), which vary in composition from their central axes to the midspace between axes

Cold-worked alpha brass (X200) This is an alpha brass cold-rolled to a 60% reduction of area. Note the twisted and warped areas



Initiation of recrystallization of a cold-worked alpha brass (X75) This is an alpha brass that had received a 60% reduction. It was then heated to 570 F for 30 minutes. Note the multitudes of very small new grains and some of the old deformed areas still containing the twisted markings

1.0% of Added Metal	% Zn equivalent
Si	10.0
Al	6.0
Sn	2.0
Magnesium (Mg)	2.0
Pb	1.0
Fe	0.9
Mn	0.5

It has, in addition, been found that 1.0% of Ni is equivalent to 1.2% of Cu.

One might ask, "What does this Zn equivalent mean?" As an illustration of the value of this knowledge let it be assumed that one is fabricating an arbitrary alloy of composition 68% Cu, 31.5% Zn and 0.5% Al. This adds up to an equivalent Zn composition of $31.5 + (0.5 \times 6.0) = 34.5\%$ Zn, well within the alpha brass range and therefore, ductile. Supposing that during the melting of more of this analysis, an error occurred in the process and the Al content went from 0.5% to 1.5%. This would be a Zn equivalent of 9.0%. Now the total Zn content would be $31.5\% + 9.0\%$ or 41.5%. This brings the alloy into the alpha-plus-beta range. From the above discussion, it is known that beta phase is not readily cold-worked. Thus, it is quite conveivable (and it has happened in industry) that the articles being fabricated would rupture and cause production to be disrupted. Checking under the microscope would show up the beta brass, while a chemical analysis would indicate why the beta phase appeared. If the Zn equivalent had been determined in advance it could have been rejected before it disrupted production.

Zinc when added to Cu improves the tensile properties without sacrifice of resistance to tarnish and corrosion. These alloys are easily buffed, finished, and plated and thus can be stamped, spun, drawn and formed. Adding up to 3% of lead improves the machinability of brass for high rates of production. The lead does not seriously modify the properties of the brass.

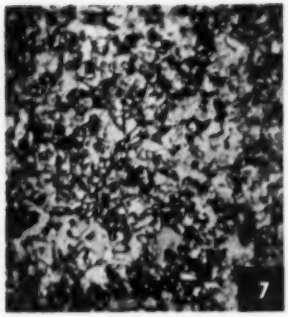
Heat Treatment of Brass Alloys

Alpha and Beta Brasses – Brass alloys, either of all-alpha phase or all-beta phase, do not readily respond to heat treatment, as do, for argument's sake, carbon or low-alloy steels. However, several fundamental things do occur when alloys of these brass types are subjected to heat treatment. They are:

A. The more rapidly the molten alloy is cooled, the finer are the resultant grain sizes.

B. Cooling of molten alpha brass causes the microstructure to be "cored"; ie, the grains are not homogeneous in composition as in Fig. 1 and can show tree-like growths called dendrites in the structure, Fig. 4. This condition involves a non-uniform solidification of the structure with Cu-rich alloy freezing out first. This is followed by solidification of the balance of the liquid Zn-rich alloy, which freezes out upon the initially solidified Cu-rich sections. The more rapid the cooling of the molten metal, the more exaggerated is this condition. Coring can be detrimental to the forging or other properties of an alloy. In contrast to alpha brass, beta-brass alloys do not exhibit this coring effect.

C. A cored structure may be heat treated to homogeneity; have the Cu-rich areas diluted by the Zn-rich areas to obtain a chemically uniform structure and one free of coring; a structure similar to Fig. 1. This can be brought about by heating the structure to a high temperature below the alloy's melting point and holding for a period of time. The higher the temperature, the less the time required, and vice versa. Increasing the temperature, however, is much more effective in homogenization than is increasing time at temperature. The usual criterion is that an increase of 18 F is equivalent to doubling the time.



Completion of recrystallization (X75) Same as the specimen of Fig. 5, except it was reheated for 30 minutes at 750 F. Recrystallization is now completed. No old deformed areas are visible

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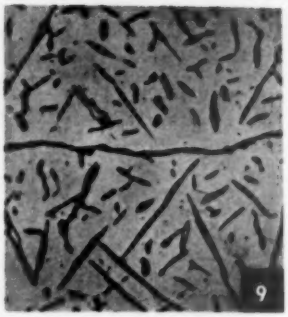

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B. A more rapid cooling, an air cool, of the alloy from the temperature range where only beta exists will not allow the formation of as much alpha as previously formed.

C. By an even more rapid cooling (water

ROUND TABLE

Adlai or Ike

"I wish we had all Republicans or all Democrats in the shop, Ed; I'm afraid I have trod on a few toes by asking Harris and Brown if they didn't have time to discusss the political situation during their noon hour."

"First thing you know, Al, you'll have Adlai and Ike on your neck. Where is there a better place to discuss current events than the shop? You wouldn't want the men to have to go to a bar to thrash out their differences, would you?"

"The point is, Ed, that all this yapping around costs the company real dough. I wouldn't mind it so much if it was a casual remark, but, doggonnit, man, there were four fellows wrapped around the column of the radial drill going to it like they did at the conventions. I don't like to be a wet blanket and cheat the fellows out of a little fun, but there is a limit to how much time they should waste."

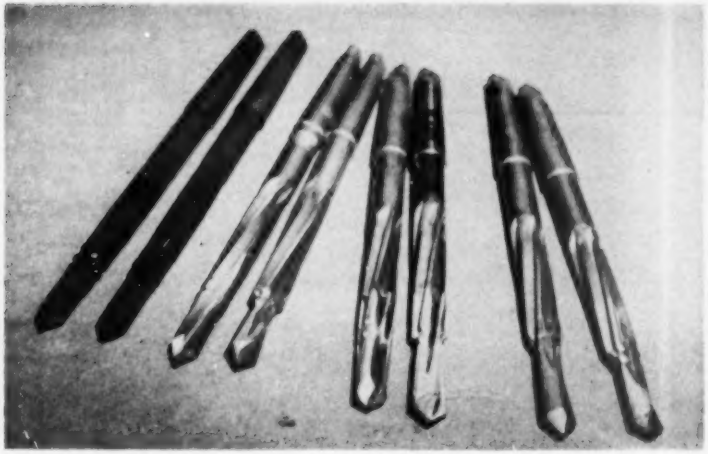
"What's the matter with you, Al? Aren't you taking things too seriously? You can expect the men to be enthusiastic over the political situation at a time like this — remember, man, we're at the crossroads and it's a serious decision the boys have to make. One man is concerned about the relative advantages of continuing on the road paved with honey and high taxes or tightening up his belt to shake down a machine that's about to strangle his liberties. Another one is worried about the reactionaries getting back into power and pushing him back 20 years. That takes talk to iron out."

"All right, Ed, they are interested — but what I'm interested in is the welfare of the company. We can't very well put up a notice that political discussions are taboo on the company time, but we can expect the men to be fair about it and cut it down to the minimum while working on the company time."

"That's one of the chances we take in a democracy, Al; it's for the company interest that the men be well informed. What better way to inform them than by enthusiastic discussion?"

"First thing I know, you'll be advising that we shut off the power for a spell to let the men fight it out."

***WHO PAYS** for political discussions? It is something the company must accept, or something that should be outside the plant? Your ideas and opinions will interest others. Discussions of earlier topics appear on later pages.*

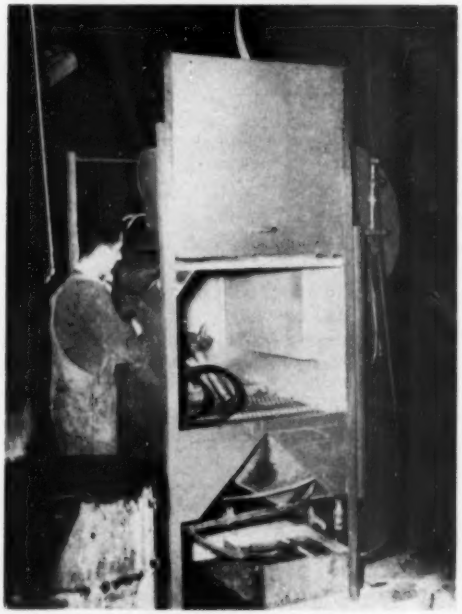


DRILLS IN FOUR STAGES of Olinizing process. Pair at left are new drills with nitride scale. Second pair has been wet blasted to remove scale and prepare surface for plating. Third pair has been flash chrome-plated for 2 in. from tip. Pair at right has received final wet blast, is ready for use

REGRIND AND BREAK-IN BLASTED FROM

A combination of close control in the plating process and wet blasting before and after plating of tools eliminates regrinding and break-in. At Oling Tool Co, South Bend, Ind. the process—called Olinizing—is applied primarily to such tools as taps, reamers, drills, and broaches. Surfacing was originally by wire brushing and pickling, but this method could not be adapted to produce the finish desired after plating. Wet blasting cut time and labor requirements. For example, 25 drill bits as a group are blasted in the time formerly required to surface 5 or 6. Here, step by step, is the procedure Oling follows in chrome-plating tools.

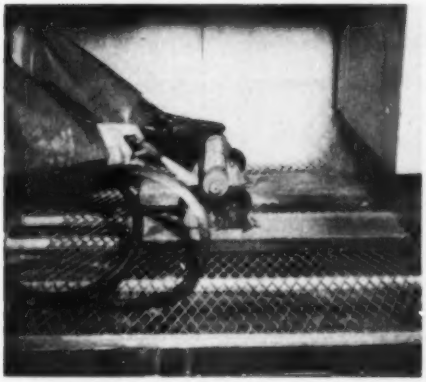
Photos courtesy American Wheelabrator & Equipment Corp.



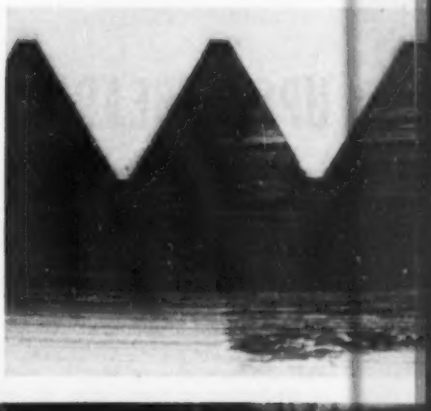
WET BLASTING in a Liquamatte cabinet with 1250-mesh abrasive suspended in water does not dull the cutting edges. Light burrs or feather edges are removed. If left on the tool, these are plated, break off in service, and remove plate from cutting edge

DEGREASING is first step in process. These are used broaches which will be plated to build up worn surfaces. New tools receive a flash plate to increase tool life. After degreasing, there is a hot caustic dip for oil removal, and an acid rinse to make parts chemically clean

CHROME-PLATED TOOLS



AFTER PLATING, broach is wet blasted again. Smooth chrome plate on tools required break-in period because lubricating oil beads on the surface. Blasting produces a surface that wets immediately in service. This is said to reduce galling from plastic or non-ferrous metals and tool loading when machining cast iron



EFFECT OF BLASTING before plating is shown in view of tap teeth magnified 20 times. At right is condition of a new tap. Grinding lines are reduced and a matte finish results from blasting at left. This provides increased surface area for plating, improving the bond

BROACH IS LOWERED into plating tank by pulley. Plate thickness is 0.002 to 0.003 in., with tolernace held within 0.0001 in. No grinding, with its danger of chipping, is necessary after plating. Leather hood covers plating tank to prevent escape of plating fumes

THESE PIECES...

STAINLESS-STEEL CONNECTORS for hot-air duct of *Scorpion* F-89 have thin walls and tight concentricity tolerances. Pieces are produced in one operation in cam-action dies at low cost

ARE MADE ON THIS DIE

UPSET BEADING DIE cold-forms bead and flange on connectors in single stroke of press. Bottom dies are stationary. Top dies, fastened to two sliding die holders, are spring-loaded in open position. Top dieset is held in location with stripper bolts and is spring-loaded. Dieset is mounted in 6-in.-stroke punch press

UPSET BEADING DIE CUTS JOB TIME 98%

Cam-action dies cold-form exceptionally high bead and flange to precision limits. New method cuts time on stainless-steel job from 3 hours to 5 minutes

BY EDWIN A DE VOSS, Tooling Engineer, Northrop Aircraft, Inc, Hawthorne, Calif

Cost reductions available in punchpress production of precision parts offer a continual challenge to aircraft tooling engineers. Exacting tolerances required in production of components for high performing jet-propelled military aircraft, like the US Air Force's Northrop *Scorpion* F-89, often mitigate against selection of punchpress forming as a fabrication method. The comparatively small quantities involved likewise may make punchpress tooling costs prohibitive. Consequently many small parts must be machined with resulting substantial costs in labor and material.

At Northrop Aircraft, Tool Engineering takes a long, "second" look at every part requiring extensive machining in an effort to develop a less costly method of manufacture wherever possible. A typical example of savings obtained this way is found in a stainless steel connector developed by Northrop for joining hot-air ducts. A duct fitted with connectors is shown above left.

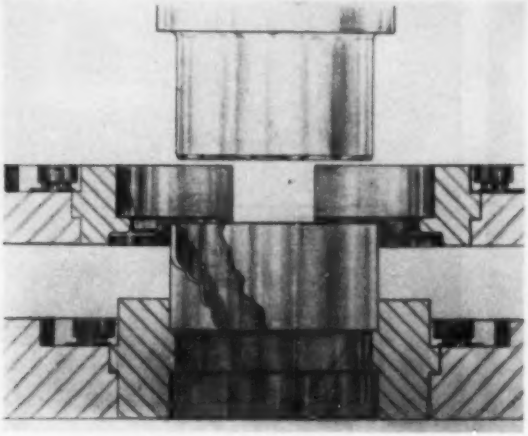
Tolerances on this job of 0.010 in. on the diameter and 0.005 in. on concentricity ordinarily would require machining. A 5.25-in.-dia duct end, however, when turned from tubing, required three hours machine time and produced two pounds of chips. This prompted development of cam-action dies which form these parts in sizes up to 2-in. dia from 0.035-in. tubing and in sizes up to 5.25-in. dia from 0.035-in. strip stock welded into sleeves.

All Dies Take Same Width Stock

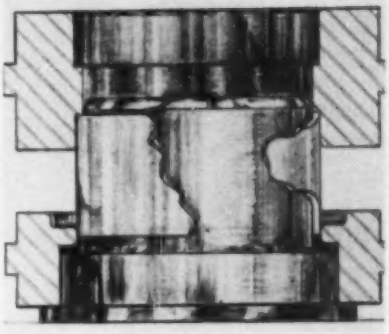
Strip stock is rolled into a sleeve and welded on a steel mandrel with a copper insert to prevent sticking. After welding, the mandrel is removed from the fixture and excess weld material is removed by sand belt. The sleeve then is forced from the mandrel which sizes it within +0.005—0.003 in. dia tolerance.

In designing the dies, punches are provided for each different sleeve wall thickness to maintain a minimum cavity between punch and die. This assures a flat flange and prevents wrinkling the sleeve. Each set of dies for various diameter parts uses the same width sleeve, so only one width of strip stock is needed. Strip is slit to width to maintain a constant dimension, is uniform in its entire length, and is much less costly than sheet.

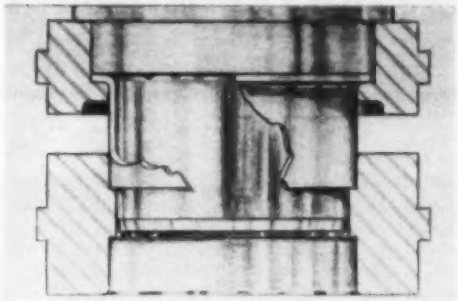
The flange height is 0.130 in, and the upset bead height is 0.180 in. max. above the sleeve OD. While



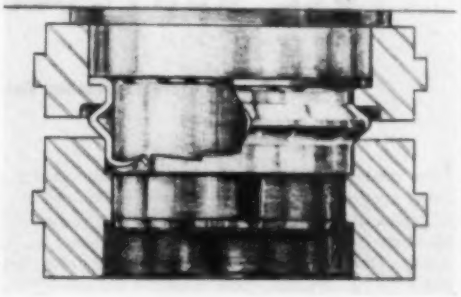
1. **TOP FORM DIES** are open. Sleeve is in bottom pusher die. Punch has started its down stroke but cams have not started to close top form dies. Bottom dies are reversible for both types of ends



2. **PUNCH** has entered sleeve. Cams have closed top form dies. As punch continues downward, radius on punch will turn sleeve into die aperture. Punch shoulder will depress top form dies over sleeve



3. **TOP-END OF SLEEVE** has been turned outwardly to form flange which stops when it bottoms against extremity of die cavity. Flange is first to form, as it requires more pressure to buckle tube into bead than to turn flange

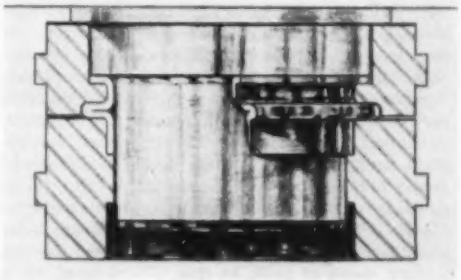


4. **TOP FORM DIES** and punch continue downward, buckling sleeve in the unsupported area between top and bottom dies. Although several lubricants were tested, best results were attained with mutton tallow. There was less galling than with commercial deep-drawing compounds

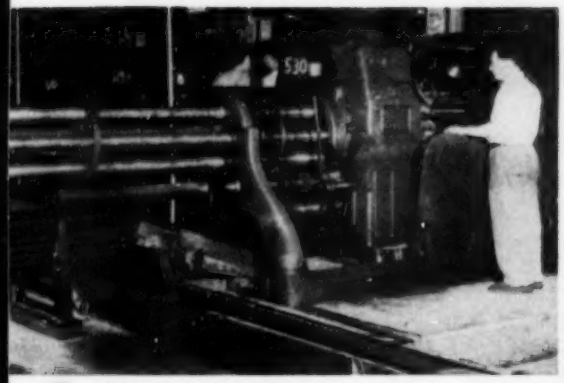
this is an unusually high bead to be formed cold, we are within the elastic range of the material. Heliarc welds are very ductile, and have given no difficulty in cracking or splitting.

Details of the forming sequence are shown. As the material is completely confined by the dies and punch it is possible to control all the physical dimensions of the completed part i.e., the diameter of the welding flange, the diameter and thickness of the upset bead, the over-all length of the part, and the diameter of the sleeve sized between the dies and punch. The width of the sleeve before forming is maintained within 0.015 in. to achieve this result.

On the upstroke, the top form dies return to position 2. Stripper bolts restrict the form dies, and the cams hold the dies together while the punch strips out of the part. The dies open and the part is free to be picked out with special tongs.



5. **DIES** have bottomed, flange has been formed, and buckle has formed an upset bead into the recess provided in top form dies. This restricts maximum height and thickness of bead. Die construction was planned to control all dimensions of completed part



FLOOR-LEVEL DRAG CONVEYOR loops around screw machine area to serve machines making fuze bodies and heads. Machines are positioned so their under-bed chip conveyors discharge into trough

of conveyor. Splashboard is attached so chips from machine conveyor fall into trough. Floor is kept clear of chips at all times. Bar stock is racked between machines in temporary storage

FULL CONVEYORIZATION ELIMINATES

Here's how Stewart-Warner ties together drag-chain, enclosed flight, and pneumatic

Two conveyors, handle all steel chips produced in Stewart-Warner's new department for making M-48 percussion fuzes for the U.S. Army. One delivers as-machined chips to a crusher, the second moves crushed chips direct to railroad gondola cars outside the plant. Capacity of the combined systems is nearly 5 tons of crushed chips per hour.

Rough chips are moved to the crusher by an unusual drag-conveyor with steel flights (scraper blades). These are moved along a steel trough by a Richards-Wilcox "Zig-Zag" conveyor chain having rigid clevis pendants spaced to support the scraper flights 30 in. apart Developed by Stewart-Warner plant engineers, the system has nearly 440 ft of conveyor chain and normally operates at 50 fpm. The 1½-hp drive, however, has an adjustable speed unit which provides a chain speed of 18 to 54 fpm.

Most chips produced in the fuze department come from a line of 2⅝-in. bar capacity Acme-Gridley six-spindle automatic screw machines which make the fuze bodies. Machines are at right-angles with the conveyor trough, so chip conveyors in the machines automatically deliver chips into the trough without attention from the operators.

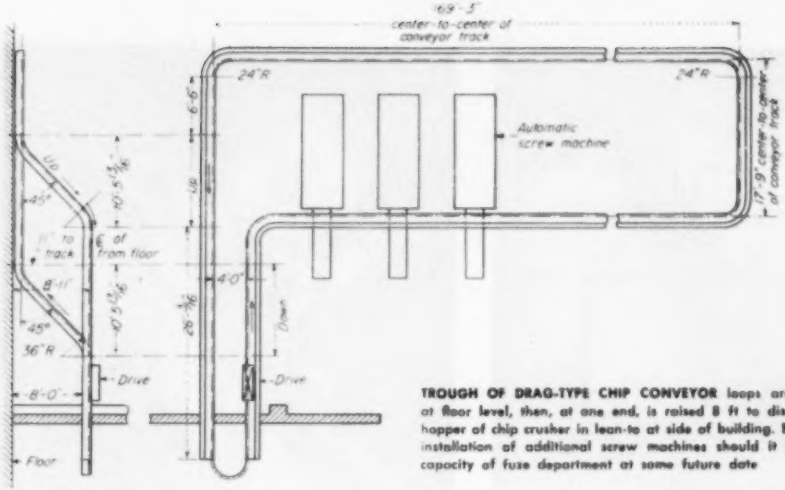
Conveyors Are Built Into Broach

Chips from several Foote-Burt continuous surface broaching machines (used to machine wrench grooves and flats on steel heads for the M-48 fuze) are delivered to the conveyor trough by individual Hapman chip conveyors built into the machines by Stewart-Warner plant engineers. Other machines in the department produce relatively small volumes of chips, and these are shoveled from chip pans directly into the conveyor trough as the pans become filled.

Chips collected by the drag conveyor are raised 8 ft and dropped through an opening in the bottom of the conveyor trough directly into a No. 2400 American chip crusher. Cutting fluid carried up the 45° slope of the conveyor trough, as it approaches the crusher, is drained through a grid into a trough under the conveyor. It flows down this trough to a collecting tank at floor level for processing and reuse.

Crushed chips drop from the pulverizer into positive-feed valves leading to the "Chip Veyor" pneumatic chip-handling system installed by National Conveyors Co. This system blows the chips through a 6-in. ID pipe line to a jib-supported discharge head some 200-ft from the crusher. Here the discharge head can be located above either of two railroad tracks to deliver chips directly into gondola cars.

Movement of chips by conveyor reduced materially the floor-space required for the fuze department. It is not necessary to provide room for chip carts at each machine and space that would have been needed for moving the carts into side aisles has been used for racking steel bars at each screw machine. This, in turn, has reduced the size of the bar stock storage area needed to serve the fuze department.

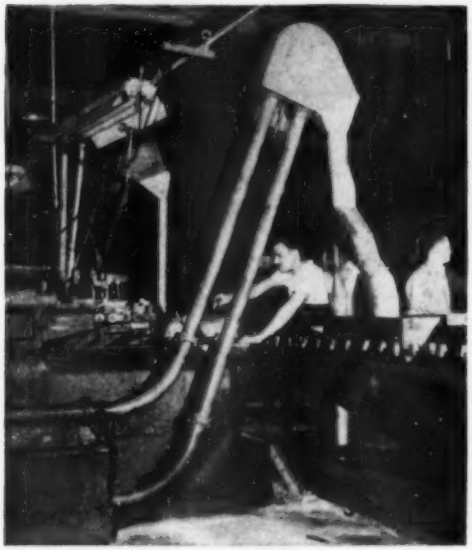


TROUGH OF DRAG-TYPE CHIP CONVEYOR loops around screw machine line at floor level, then, at one end, is raised 8 ft to discharge chips directly into hopper of chip crusher in lean-to at side of building. Enclosed area provides for installation of additional screw machines should it be necessary to increase capacity of fuze department at some future date

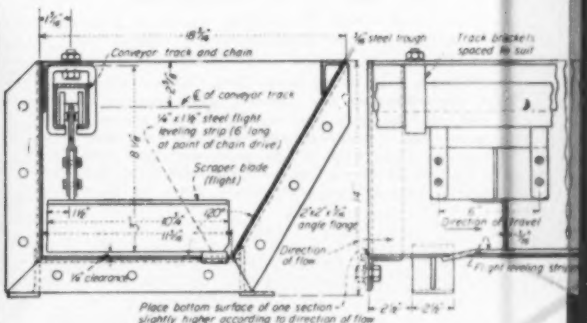
MANUAL CHIP HANDLING

BY DAVID C PETERSON
Director of Engineering & Manufacturing
STEWART-WARNER CORPORATION

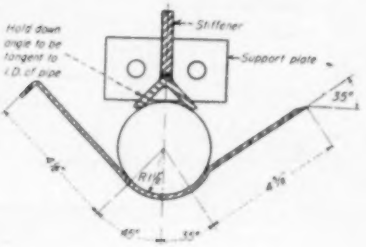
conveyors to move chips from machines to gondolas without manual effort



ENCLOSED FLIGHT CONVEYORS delivers small chips produced by Foote-Burt continuous surface broaching machines to drag conveyor. Unit is individual Hapman conveyor built into machine base. Discharge is either direct to drag-conveyor trough or to holding bin mounted above trough to catch chips when drag conveyor is stopped. At right is section of chip collection hopper in machine base


Conveyor track and chain
3/16" steel trough
Track brackets spaced to suit
℄ of conveyor track
14" x 1⅛" steel flight leveling strip (6' long at point of chain drive)
Scraper blade (flight)
2½" x 2½" x ¼" angle flange
Direction of travel
Direction of flow
½" clearance
Flight leveling strip
Place bottom surface of one section slightly higher according to direction of flow

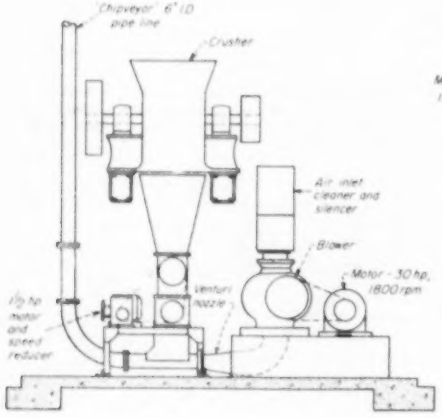
CONVEYOR TROUGH has one sloping side, is made in 10-ft sections except in a few cases where shorter lengths were needed. Leveling strip 6-ft long, takes side load off chain links in trough section at 1½-hp drive station

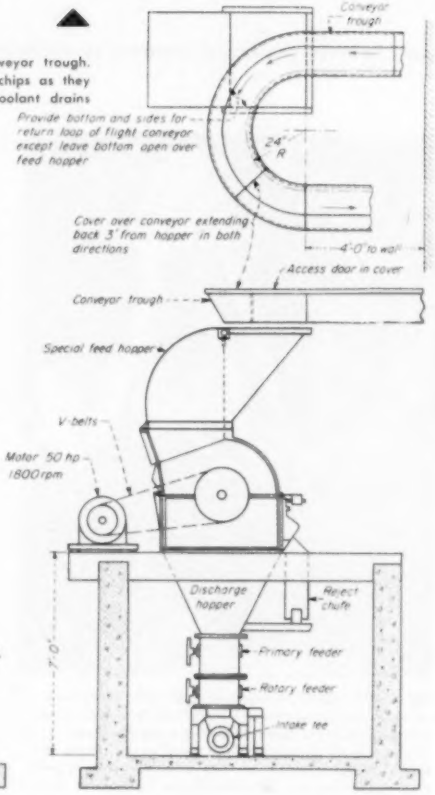


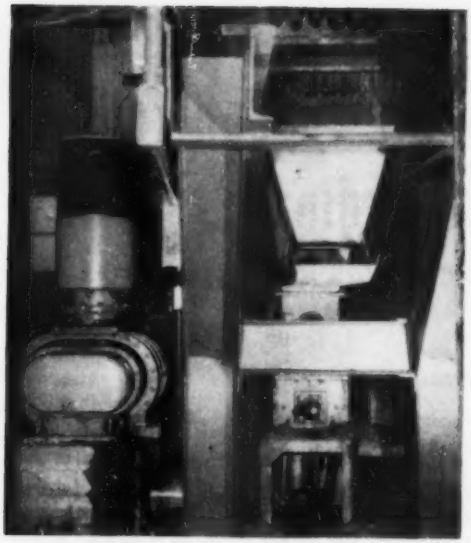
TROUGH INCLINE near discharge end of drag conveyor rises 8 ft at 45° so chips can discharge direct to crusher without attention. Conveyor chain drive is mounted on platform at upper level, but control switch is on wall for operating convenience

BLOWER dries chips as they move up riser of conveyor trough. Driven by 1/5-hp motor, fan blows air down over chips as they cross drain grid in bottom of trough. Soluble-oil coolant drains through grid for return to machines

CRUSHER is driven at 900 rpm by 50-hp, 1800-rpm motor. Bottom of drag conveyor trough is open over crusher hopper so chips fall freely as flights move across opening. Feed of crushed chips to venturi nozzle is at measured rate through two rotary feeder valves driven by 1½-hp motor through speed reducer and chain. Compressed air for blowing chips through pipe line comes from 10x24 Sutorbilt positive displacement blower driven by 30-hp motor







CHIP CRUSHER AND BLOWER are above ground in the Stewart-Warner installation to permit easy maintenance. Usually units shown are deep in pit, with little room for repairmen when needed

DISCHARGE HEAD of pneumatic chip conveyor is on 9-ft boom. Steady stream of pulverized chips flows into gondola without having been handled manually since falling from screw machine

Tips FOR TOP SHOP MEN

439 When you describe a process, be direct and virile, not passive and dead. Say, ". . . drill a 5/16-in. hole"; not, ". . . a 5/16-in. hole should be drilled."

440 Just as in the old days, a boss could be too tough, he can now be too easy. Some people consciously abuse privileges. Be alert for the abuser, for his abuses will multiply—and be copied by others.

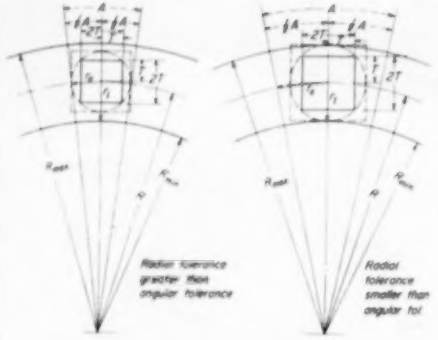
441 Reminding somebody to do a job, or even making a report or writing a memo about it, isn't enough. People forget. You must follow up until the job is done. Sometimes that will make you a nuisance, but anybody who accomplishes anything is likely to be called a nuisance occasionally—by somebody who hates to accomplish anything.

442 Most men with "masterful memories" also have "fabulous forgetters", although they'll rarely brag about the latter. They readily forget the things they're not interested in, or the things they don't want to do. Don't assume that the man with a good memory for certain things has a good memory for everything; he hasn't.

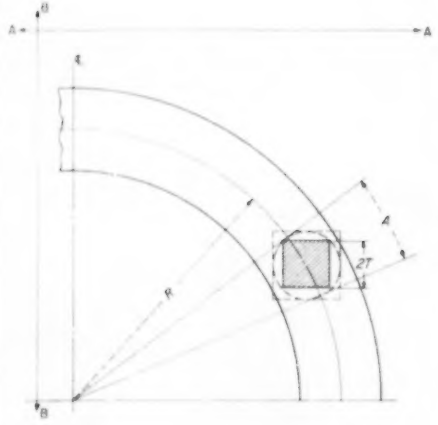
443 If you're dealing with a man who puts everything in writing, be sure your part is in writing too. Otherwise his carbon copies of what he's done can be shown later, and in the absence of any written evidence that you've done something about it, those carbons will crucify you.

444 Even though your shop is spotless, stage a periodic cleanup campaign. You'll be amazed at how much orderly junk turns up.

LOOK OUT BELOW!
DON'T GET EXCITED! THOSE OLD BOXES ARE ALL EMPTY—WE DON'T NEED ANY NEW HELP NOW—WE JUST FOUND OUT WHERE TH' OLD HELP HIDES OUT.
DANGER HIGH EXPLOSIVES
"A GAIN IN MAN HOURS."



COORDINATE TOLERANCES are confined by very exacting limits; should never be approximated as even slight errors can be troublesome and expensive. When the radial tolerance is larger than the angular tolerance, determine the largest possible circle that can be scribed within the borders of angle "A". This circle has a radius, r_a. Then, if this circle is circumscribed by a square, corners of the square will fall outside of the angular tolerance. Similarly, when the radial tolerance is smaller than the angular tolerance, a square drawn to the equivalent radial tolerance will have corners protruding beyond the outer circumference. This circle has a radius r_t. Thus, neither tolerance is suitable in itself. To solve a problem, the mean of the workpiece tolerance must be obtained, relative to the "A" and "B" coordinates



LOCATING POINTS for other holes on the circle will cause the corners of the oversize tolerance square to change its relative position. The only safe tolerance square for a hole located at any point on a circle and relative to the leadscrews "A-A" and "B-B" is the one inscribed in the circle, the square whose side is 2T

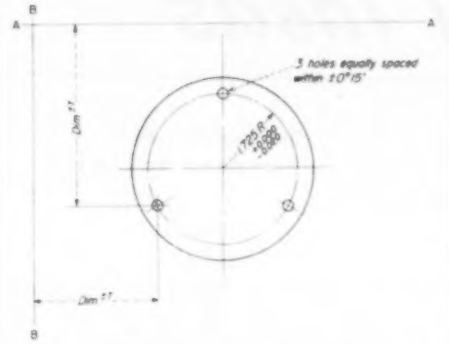
How To Control Coordinate Tolerances

Hole location frequently involves compound functions which are not always what they seem. Efficient shop practice frequently requires that holes be located on a coordinate grid, yet many engineers still locate holes on a circle. In converting from circle to grid, tolerances are often guessed at, are smaller than necessary, hence costly. Here is how to *calculate* the tolerance

BY ALBERT L LEVITT, Plant Manager
National Food Slicing Machine Co. Inc. Bronx, N. Y.

Many papers have been written to describe methods for obtaining the dimensions required when locations on a hole circle must be translated into coordinates (*AM*—May 29 '50, p 109). None of the papers that I have seen included a method for determining the tolerance to be applied to these coordinate dimensions. Too often, people guess at the tolerances or rely on previous experience. Nothing is more conducive to trouble.

Coordinate tolerance is controlled by two factors: radial tolerance and angular tolerance. When the radial tolerance is greater than the angular tolerance, the formula $r_a = R \sin \frac{1}{2} A$, with R the mean radial tolerance, is used to determine the radius of the largest possible circle that can be scribed within the borders of angle "*A*". If, then, a square is circumscribed about the circle, this "tolerance" goes beyond the angular lines. However slight this distance may be, it should not be neglected. The phantom square represents the two leadscrews of the machine's locating device, hence locating holes at other points on the circle will result in the corners of the square changing its relative position. Thus, the corners will protrude beyond the angular-tolerance lines and sometimes beyond the radial-tolerance lines. The only safe "tolerance square" for a hole located at any point on a circle



AS A SAMPLE PROBLEM, consider a part with 3 holes equally spaced within ± 0° 15 min. on a 1.725 $\frac{+0.000}{-0.020}$ — in. radius bolt circle.

1. Using the dimension 1.725 $\frac{+0.000}{-0.020}$ in., we obtain the mean dimension R = 1.625:

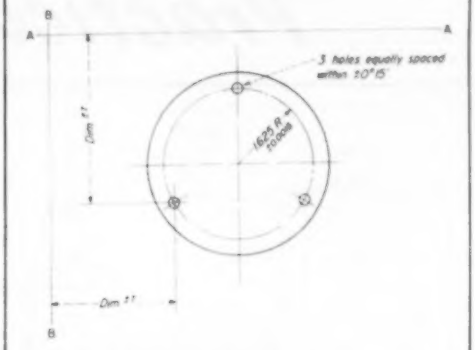
$$R = \frac{R_{max} - R_{min}}{2} + R_{min} = \frac{0.020}{2} + 1.525 = 1.625 \text{ in.}$$

2. Using R = 1.625 and the sine of one-half the overall angular tolerance, 30 min., (0.00436), $r_a = 0.007085$:
$r_a = R \sin \frac{1}{2}A = 1.625 \sin 15 \text{ min} = 0.007085$ in.

3. Designate one-half of the radial tolerance $\frac{+0.000}{-0.020}$ in. as r_1, which equals 0.010 in. (Note that plus and minus are unequal, as may happen.) Next, select between r_a and r_1 the numerically smaller radius and designate it as r. Thus, $r_a = r = 0.007085$ in.:
$r_1 = R - R_{min} = 1.625 - 1.525 = 0.010$, larger than r_a; hence $r_a = r$.

4. Obtain the tolerance T by dividing r by the constant 1.4142. T must then be given the proper sign, plus or minus, when used with the coordinates A—A or B—B

$$T = \frac{r}{1.4142} = \frac{0.007085}{1.4142} = 0.005 \text{ in. or Dimension } \pm 0.005 \text{ in.}$$



TO CLARIFY FURTHER, take a similar part, or perhaps its drill jig, having the same angular tolerance (±0° 15 min) but a tighter tolerance in its radius: 1.625 ± 0.0015 —in. Then,

1. $R = \frac{R_{max} - R_{min}}{2} + R_{min} = \frac{0.003}{2} + 1.6235 = 1.625$ in.
2. $r_a = R \sin \frac{1}{2}A = 1.625 \sin 15 \text{ min} = 1.625 \times 0.00436 = 0.007085$ in.
3. $r_1 = R - R_{min} = 1.625 - 1.6235 = 0.0015$ in.
4. r_1 is smaller than r_a, hence $r_1 = r$
5. $T = \frac{r}{1.4142} = \frac{0.0015}{1.4142} = 0.001$ in., or Dimension ± 0.001—in.

and with any relation to the leadscrews is the square *inscribed* in the circle.

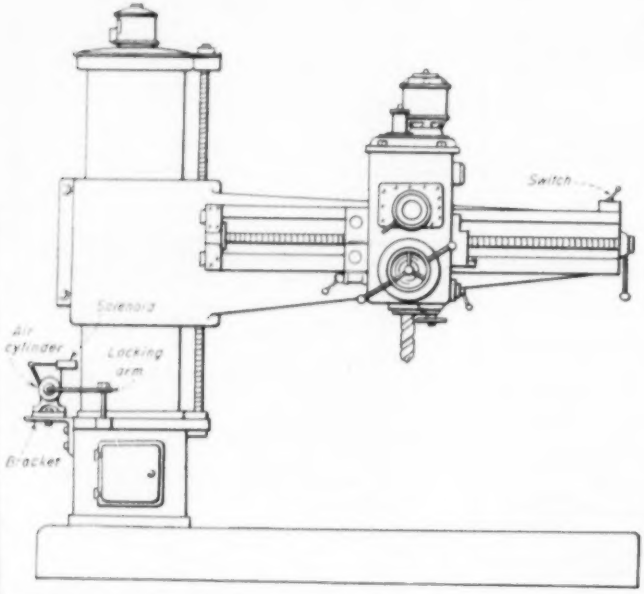
The same relationship exists when the radial tolerance is less than the angular tolerance—where the prime concern is the minimum and maximum radius as determined by the workpiece tolerance. If one-half of the radial tolerance is used for the coordinate-dimension tolerance, the corners of the "tolerance square" will protrude beyond the outer circumference.

To solve the problem correctly, the mean of the workpiece tolerance *must* be obtained by the $R = \frac{R_{max} - R_{min}}{2} + R_{min}$, for the radius. Then, one-half of the full angular tolerance is taken for ½ *A*, the mean angular tolerance. With these established, $r_a = R \sin \frac{1}{2}A$ and $r_1 = R - R_{min}$. Taking the smaller value between r_a and r_1 for r, the tolerance $T = \frac{r}{1.4142}$ and 2T equals the coordinate tolerance.

Tool designers should always follow this procedure, especially when designing drill jigs. Jigs, generally, are not designed so that they may be rotated to locate the bushing holes, hence coordinate dimensioning is necessary. Also, jigs are made to closer tolerances than the parts to be drilled in them, thus the tolerances are even more critical. The same conditions prevail in laying out templets for optical-comparator inspection.

"Boy, what a chip-breaker you put on this tool, Luke!"

Practical Ideas



Remote Column Lock for Radial Drill

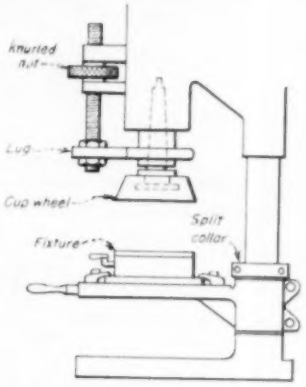
One of the operations performed in our shop is drilling numerous holes in 8-ft square sections of 1½-in. thick armor plate. Every-time we drill a hole it is necessary to walk to the column end of the arm to unlock the column, return to reposition the drill, and then walk back again to lock the column before drilling the next hole.

We beat this bottleneck with an old 3-in. dia air cylinder that had an 8-in. stroke and a reverse valve. The stroke was sufficient to pull the clamping lever on the column. We mounted the air cylinder on a swivel bracket and bolted the bracket to the base of the column. On the end of the piston-rod we attached a brake clevis; then we sawed off the handle on the locking lever, drilled a ⅝-in. dia hole in the end of the lever, and pinned the clevis to the lever. On the air cylinder we mounted a 110v-6 pound pull solenoid to operate the cylinder reverse valve lever. The air cylinder is fed from our shop air supply through a regulator set at 25 psi.

Three inches above the handle provided at the end of the radial arm for swinging the arm, we installed a 10-amp toggle switch in a steel junction box. From the toggle switch, the wires travel, in a rigid conduit, along the radial arm, then through a flexible conduit to the solenoid.

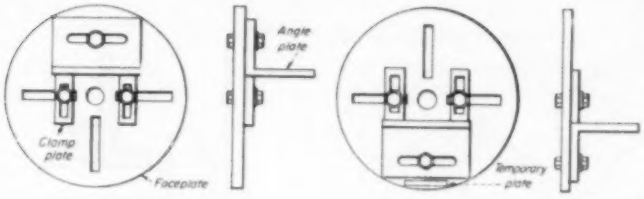
Throwing the switch to the "on" position causes the solenoid to operate the reversing lever, thus actuating the air cylinder and locking the column by pulling on the clamping lever. When the switch is flipped to "off", the procedure is reversed and the column is unlocked. The saving in time, plus the reduction in irritation and fatigue, have made this installation well worthwhile. *Irving Epstein, Seattle, Wash.*

Surface Grinder from Bench Drillpress



An arbor was made for the cup wheel and was locked in position in the drill spindle by a setscrew. Then, the swinging table was drilled and fitted with a handle and a split collar was clamped on the column to stop vertical movement of the table. A knurled nut and stud were fitted to the spindle housing and connected to the spindle with a split collar having a drilled lug to take the stud. This served as the feed adjustment.

For the first job, a fixture was used, but extensive use has been made of our "temporary" grinder since then by adding a magnetic chuck. Grinding is possible to surprisingly close limits. *L T Smith, Liverpool, England.*



How to Set Up a Heavy Angleplate

I was given the job of boring some duplex pump bodies which called for a specific distance from base to centers and a specific center distance between cylinders. Also, the cylinder bores had to be parallel.

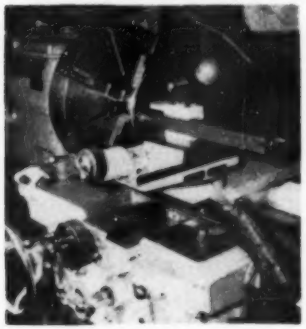
To begin the setup, I blued a lathe faceplate and scribed a line across it the same distance from its center as the base-to-center distance of the pump body. After mounting the faceplate on the lathe and engaging the backgears to prevent rotation, I bolted two clamp-plates on the faceplate as shown, so that their end-edges were aligned with the scribed line and their sides were parallel to each other and perpendicular to the scribed line. Then, I placed an angleplate so that it rested on the clamp-plates and clamped it to the faceplate with one bolt. (This job can be done by one man and, after the angleplate is clamped, releases the crane for other work.) Next, I fastened a balance weight on the faceplate directly opposite the angleplate and bolted the pump body to the angleplate so that the first hole to be bored was approximately centered. The pump body was not unbolted until boring was finished. Finally, the backgear was released.

If, when the faceplate is revolved, it is necessary to move the angleplate nearer to the lathe center, for example 0.030 in., the faceplate is rotated until the angleplate is at the bottom position. Then the clamp-plates are loosened slightly, a 0.030-in. thickness gage is placed between them and the angleplate, and they are tightened again. After removing the gage, the angleplate is loosened, slid solidly against the clamp-plates by rotating it to the top position, tapping gently, and retightening.

To move the angleplate away from center, its weight prevents reversing the above procedure, hence a parallel should be clamped at the required distance behind the angleplate, the angleplate loosened, slid to it, and clamped in place. Then, the clamp-plates are loosened, brought up against the angleplate, tightened, and the temporary parallel is removed.

For horizontal alignment, as well as positioning the second bore, a line is scribed on the faceplate parallel to the side of the angleplate, a parallel bar is clamped along this line, the angleplate is loosened, moved to this bar, and clamped.

Before boring either cylinder it is important to provide additional clamping to hold the angleplate securely during machining. *Thomas Gray, Belfast, Northern Ireland*

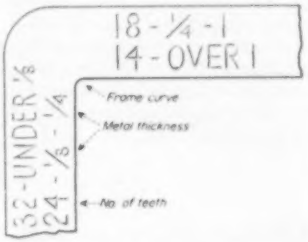


Turning a Parabola

Machining an accurate parabolic curve is not the easiest job in the shop, but that is what we were asked to do—for a special steel reflector.

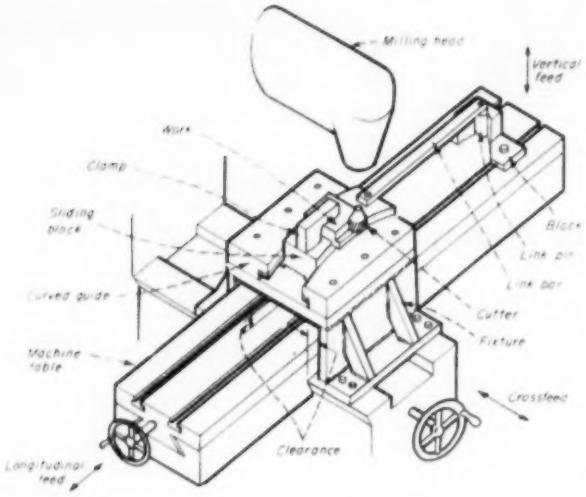
The job was completed satisfactorily by making a templet to the exact curve and attaching it firmly to the cross-slide of the lathe. With a dial indicator, the templet was aligned with the carriage traverse and the cross-slide. An indicator was then attached to the lathe bed, by means of an extension arm and bracket, so that its point contacted the templet edge.

The cutting tool was positioned at the proper place on the workpiece and the indicator point was set in the corresponding position on the templet. With the indicator pointer advanced several revolutions, the dial was set to zero. By using very slow power feed on the lathe carriage and relatively high spindle speed, it was possible to keep the indicator pointer between ±0.001 in. by manually operating the cross-slide. The reflector was satisfactorily contoured. *James Heatley, E McKeesport, Pa.*



Hacksaw Blade Saver

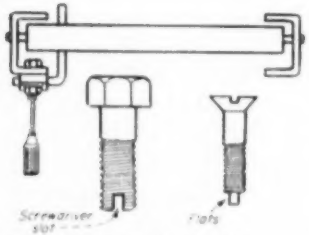
By lettering the flat surface of a metal hacksaw frame with an electric etching pencil, as shown, information describing the proper number of teeth in a blade to be used for sawing specific thicknesses of metal is always convenient. There is then no excuse for using the wrong blade in the saw when the proper blade is available. *Thomas Trail, Catonsville, Md.*



How to Mill a Large Radius

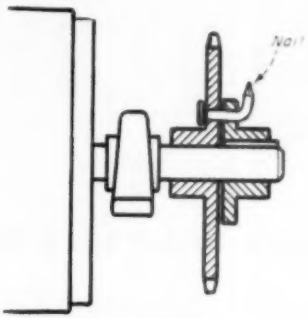
Sometimes it is necessary to mill a radius larger than can be produced on an ordinary rotating table. To accomplish this operation we built a special fixture which is bolted on the knee of an ordinary vertical milling machine. On the device are bolted two guide-curves in which move a sliding block. The workpiece is held on the sliding block by a clamp. To provide positive feed, the sliding block is linked to the milling table.

In operation, the longitudinal feed of the table is used to pull the sliding block, together with the workpiece, through the curved guide block. The clearance between fixture and table permits a slight adjustment of the table in the transverse and vertical directions. To allow for vertical movement, the link pin is free to move in the block. For each radius, use a separate guide-curve and slider. *E Winkler, Grunegg, Switzerland*



Tightening Hidden Bolts

To tighten a nut on a bolt when, for some reason, the bolthead is inaccessible, hold the bolt stationary at the threaded end and turn the nut into place. If the bolt diameter is small, file flats on the threaded end, start the nut by holding the threaded portion of the bolt or screw with your fingers, and then tighten the nut with a wrench after gripping the flats with pliers. For larger bolts cut a slot in the threaded end and proceed as above, using a screwdriver in place of the pliers. Both methods will prevent thread damage; do not weaken the bolt. *Sidney V Worth, New York, NY*

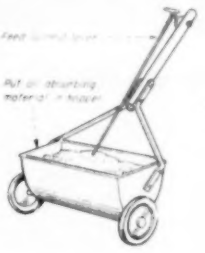


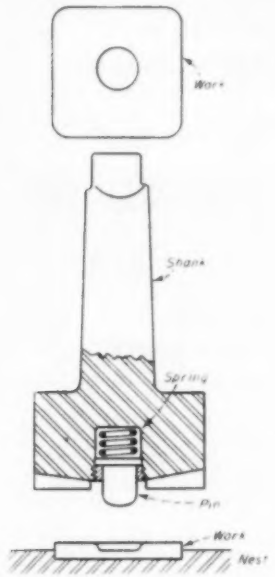
Make Shear Pins Shear

Shear pins are supposed to be used as safety devices, to shear before some other, more complicated, part of the machine fails. Unfortunately, every now and then someone who might have been forced to replace several pins, will use a hardened rod or pin that is stronger than the critical part requiring protection. The original intent is lost. When this happened several times in our plant and drive chains were being broken regularly, our plant engineer redesigned the equipment so that common nails had to be used instead of regular pins. As nails are "soft", future trouble with hardened pins was eliminated. *S V Worth, NY, NY*

Oil-Absorbent Spreader

A lawn-seed planting cart is very useful as a device for evenly spreading oil-absorbent or sawdust on shop floors. The material is placed in the spreader hopper and the quantity dispensed is controlled by the feed-control lever. With this method the job is done more rapidly and evenly; also, less material is used. *Fred Lettino, Astoria, NY*



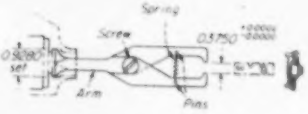


Workholding Endmill

Thin diecast or forged parts can be surface-machined without special clamping by the use of this special endmill. The tool is made with a center hole, part of which is threaded. A spring-loaded pin is inserted into this hole and held in place by a nut.

The work is held in a nest which is shaped to fit the part.

When used on a vertical milling machine or a heavy drill press, the spring-loaded pin holds the work in position before the endmill teeth start to cut and continue to hold it as cutting proceeds. As the work need only be placed in the nest, both clamping equipment and the time required for clamping are eliminated. Nests can be quickly made by using low-melting-point alloys such as the Cerro-alloys or Kirksite. *Haim Murro, Boston, Mass.*



Scissors Gage Measures Hidden Diameters

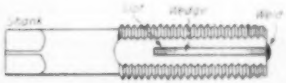
A relatively easy method for measuring the diameter or contour of an inaccessible recess is provided by the scissors gage. Its arms are usually made from flat ground stock, with their ends bent slightly to bring them opposite each other. A shoulder screw is used as a hinge pin to give a swivel fit.

The gage is inserted into the part and a gage block, or feeler gage, is used to measure the dimension at the outer end. For production, a gage can be ground to the maximum and minimum dimension. *Leo A Pittella, Cambridge, Mass*

Back-up Bars for Chucking

For lathe-facing a piece that must finish thinner than the jaw-step depth, it is necessary to place an accurate spacer between the back of the piece and the jaw face. Small pieces of ground stock are frequently used for this spacer, but it is difficult to hold them in position while the work is being trued.

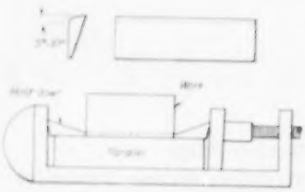
Spacers which will stay in place on the chuck jaw, but which can be detached readily, can be made from short pieces of drillrod. Each end of the drillrod piece is turned to permit slipping on the loop end of a tension spring. The length of the full diameter portion of the rod is about equal to the chuck jaw width. As shown, the tension springs are slipped over the chuck jaws to hold the rod in place while the work is adjusted. These spacers will work on 3- or 4-jaw chucks and drillrod is available in a wide range of accurate diameters. One set of springs suffice for several sizes of spacers. *Clifford T Bower, London, England*



Expansion Tap

Production of 90-mm cartridge cases stopped when cases made from a new shipment of material were rejected for tight threads in the primer hole.

Many shop tricks were tried to make taps cut threads to gage size, but all failed. Only new, oversized taps seemed to be the answer. As a last resort, we used a rubber wheel to slot the end of the tap 1½-in. deep. Then we drove a flat wedge into the slot until the expanded tap would cut the thread to a perfect gage fit. A spot of weld was applied to hold the wedge in place and also restore tap rigidity. These taps worked very well and kept us going until oversize taps could be obtained. *Abram Hill, Philadelphia, Pa.*



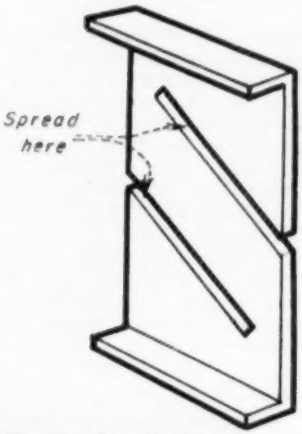
Vise Hold-Downs

Some ideas are new *and* practical. This one is *not* new, but it is practical—and many mechanics seem to have forgotten just how useful hold-downs are.

When a workpiece is clamped in a machine-vise on a machine such as a shaper or miller, there is always the possibility that the piece is not held parallel to the bottom of the vise. This results from the jaws having a tendency to bell-mouth when clamping pressure is applied, thus lifting the piece off the bottom of the vise.

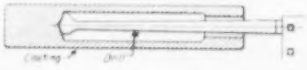
Hardened and ground parallel hold-downs will prevent this condition. The slight taper in hold-downs, which may vary from 5 to 10 degrees, transmits the hold-down pressure from a lower part of the vise jaws to the base of the work, thus assuming accurate positioning. Hold-downs make it possible to hold thin work as well as pieces with shoulders and irregular sides. Sometimes it is better practice to insert a piece of paper between the work and the vise bottom to increase friction and prevent slip.

Parallel hold-downs can be made or bought in lengths of 5-, 6-, 7-, 8-, and up to 12-in. Sizes up to 36-in. are available in CI. No shop should be without them. *D A Rogers, Dayton-Rogers Mfg Co, Minneapolis, Minn.*



Stop Scriber-Pad Loss

Because the scriber pads on my vernier height gages were frequently lost, I made a slight improvement which appears to keep them from straying. By simply making two saw-cuts at 45° as shown, and spreading the pad slightly, enough side pressure is provided to hold the pad in the scriber clamp. *Walter A Sauer, Belleville, Ill.*



Boring Internal Clearance

Even a plain CI roller can cause head-scratching. The roller I have in mind revolves on a plain, parallel shaft, bearing only on the ends, but the center required enlargement for clearance and the outside surface had to be perfectly sound. We tried a cored sand casting.

Our first difficulty was porosity, when the piece was purchased as a sand casting. Scrap was excessive. Then we found that we were able to obtain sound material as centrifugally cast solid bar; had to bore the hole.

We bored this bar, using a lathe and a steadyrest, at the end section to just under the finished size. Then, using an old fashioned flat drill ground with a long side to the point, we succeeded in boring the clearance portion sufficiently oversize. *John Stewart, Glasgow, Scotland*

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WHO MAY ENTER – Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER – Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 36, N. Y.

Drills and Reams Tank Suspension Support Housings

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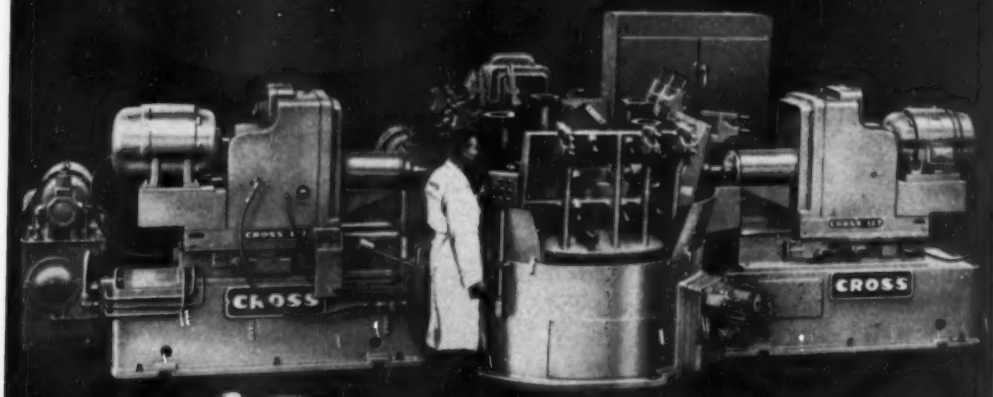

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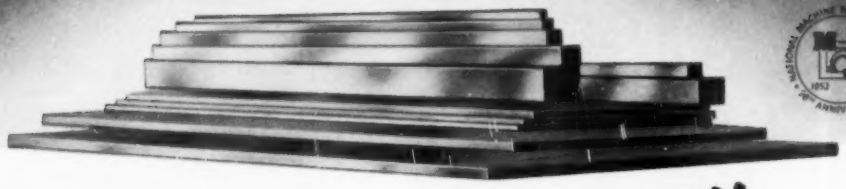

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Repair of Iron Castings...IV

Repair of Iron Castings

I. Gas and Arc Welding:

A. Extent: The flaw must first be opened up to determine the extent of the defect. This will depend upon the nature of the defect, whether it is a misrun or underfill, a coldshut or lap, a crack, broken-out section, machined-off dimension, drop, scab, rat, crush, mismatch or shift, etc, as each sort of defect has typical extents and variations.

Only after opening up and/or determining the extent of the defect can it be judged as to whether or not it is repairable. The type of the defect is not important except as it governs the extent of repair.

B. Preparation: The defective area must be thoroughly cleaned out before welding. This would best be done by flame gouging after pre-heating, carefully and properly applied, ie, so as to show by the change in color and flash of the flame that the defective areas are completely removed. It is advisable to use one of the generally accepted inspection methods, such as kerosene, or mineral spirits and chalk, black light and fluorescent oil inspection, acid etching test, or magnetic particle inspection, to be sure the defective area is completely removed.

If chipping is used, great care must be exercised to be sure defect is all removed, as chipping tends to hide the defect. The preferable chipping procedure is to rough chip, then complete cleaning by grinding, particularly if crushes or scabs are present. Sand or grit blasting may be used for mild cleaning, but cannot be depended upon for dirty or burnt-in areas.

In some cases where cracks are to be repaired, small holes are drilled beyond the ends of the cracks, which are then ground out from drilled hole to drilled hole. If the drilled holes are not beyond the ends of the cracks, the cracks will propagate under welding heat; so great care must be taken to insure getting drilled holes beyond ends of cracks.

C. Preheat: The casting must be preheated slowly and uniformly to between 900 and 1100 F, before welding, in the case of plain iron. In the case of high-strength iron, the range will be 1050 to 1250 F. The preheat temperature should be no higher than 50 F below the critical temperature of the metal, which is determined by the analysis of the casting involved.

The casting and the furnace should both start cold together, whether a batch or continuous furnace is used. The starting temperature as shown on the furnace pyrometer should not be over 350 F when the fire comes on, although in batch furnace practice, heavy castings may be charged into a furnace when the pyrometer shows 600 to 800 F. At the same time, it must be realized that castings of both thin or irregular sections may crack with sudden application of high heat.

D. Welding:

1. Gas welding: Welding should start immediately after removal from the furnace and the welding time should be held to the minimum. In the case of gas welding, instructions to the operators should emphasize that speed is essential to quality. The temperature of the casting during welding should not be allowed to drop below 700 F. Certain castings will require an even higher minimum than this, and under some circumstances it may be desirable to apply auxiliary heat during welding. Stop-welding temperatures are best checked with a contact thermocouple pyrometer or a total radiation pyrometer.

2. Arc welding: See item III, "General Nickel Welding."

E. Rod: Rod should preferably be of gray iron of such a nature that the weld has a structure and hardness comparable to those of the parent metal. Weld deposit and heat-affected zone in all cases should be of uniformly sound metal and readily machinable.

F. Flux: In the case of gas welding, a suitable flux must be used. The flux should provide adequate flotation, fluidity, or puddling, so that the welds are sound and free of slag or gas inclusions.

G. Post heat: The post-heating of castings for stress relief should be done at 1000 to 1100 F for plain iron. The temperature range should be determined by the metal analysis for high-strength iron. The post-heating temperature should not exceed 50 F. below the critical temperature. Casting must be cooled very slowly and uniformly. In a continuous furnace, castings should be cooled to 700 F maximum before removal and preferably should be carried much lower. In case there are no furnace cooling provisions, castings should be buried in powdered silocel, asbestos, lime, sand, charcoal, mica, crushed slag, etc, for heat insulation to insure slow cooling.

II. General Nickel Welding: This type of welding is performed in conjunction with a standard arc welding machine, using as low amperage as is consistent with sound deposits; and every effort should be made to hold down the heat in the casting to a minimum. This method is for the purpose of furnishing sound deposits to repair small defects in non-critical area of machined castings. It is used where subsequent machining or tapping is necessary.

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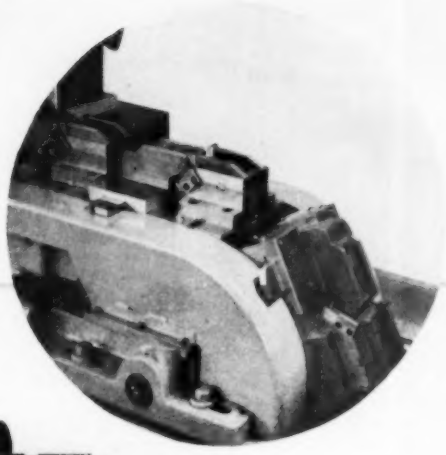
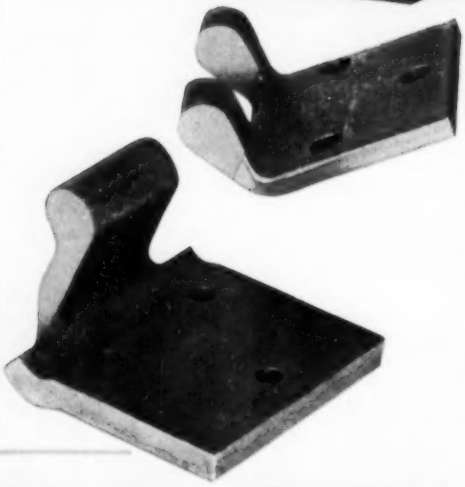
with continuous surface broaching of small parts



● Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.



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machine tools

Repair of Iron Castings...V

There is also a process called intermittent welding, which is performed by means of a technique utilizing high amperage and resulting in an intermittent arc, thus lessening the tendency toward excessive heat accumulation, which later causes hard heat-affected areas.

A. Extent: Size of the defect which may be repaired by this method is limited to minor defects.

B. Preparation: Flaw must be thoroughly cleaned by chipping, grinding or machining.

C. Preheat: No preheat is used.

D. Electrode: The arc-welding electrode used is a coated type, of commercially pure nickel or monel metal, and should not exceed 5/32 in. dia.

E. Welding: See introductory paragraph III.

F. Post-heat: No post-heat is used.

G. After the weld is completed, it should be dressed with a small grinding wheel, or subsequently machined.

III. Special Repair Conditions:

A. Gas welding with local preheat and post-heat: Gas welding with local preheat and post-heat, on semi-finished castings, is permissible under special conditions. When this operation is done correctly, the heat-affected zones are not critical; but this type of welding should be used only where there is no danger of affecting the important areas of the castings. It should be attempted only by an expert welder and then only on corners, curved areas, or on such places where expansion and contraction are not restricted.

1. Extent: Same as under gas and arc welding under 1-A.

2. Preparation: Same as 1-B.

3. Preheat: The area immediately surrounding the repair should be preheated to a dull red heat (in a dark location) or approximately 1000 F, by means of a gas welding torch, immediately prior to welding.

4. Welding: The welding procedure should conform to that described under 1-D.

5. Rod: Similar to that described under 1-E.

6. Flux: As described under 1-F.

7. Post-heat: There is no actual general post-heating in this type of welding. However, after the weld has been completed, the operator should continue to play his flame on the area around the repair in a gradually diminishing manner over a period of several minutes (depending on the section being repaired), to provide slow cooling through the critical range. See IV-A-1 and 1-G.

B. **Brazing:** Brazing with gas torch heat utilizes almost the same procedure as outlined in II-A Gas welding with local preheat and post heat, with the exception of the filler material used. A tobin brass rod or equivalent is generally used for the deposited metal, which will be stronger and harder than the nickel repair previously described. This method can be used for the repair of minor defects in such locations as bearing seat covers, locating pads, etc. A special cast-iron brazing flux should be used.

C. **Silver Brazing:** Hard silver solder and other similar materials should be considered only for individual cases requiring special treatment.

D. **Cast iron soldering:** Using the proper type of solder and flux, soldering is permissible for the repair of gasket faces or other small machined surfaces showing defects where structural strength or high temperature is not involved. Strong, uncut hydrochloric acid should be used for tinning and cleaning, and a soldering copper at dull red heat is the preferred method for applying the solder. This solder is harder than ordinary tin-lead solder and melts at a much higher temperature. Such repairs may be finished by filing, machining, or grinding.

E. **Mechanical repairs:** Plugs or bushings (steel or iron) are permissible to repair leaky areas which are subject to compressive stresses or low tensile stresses. Plugs should be of gray cast iron of approximately the same hardness as the parent material, should be taper threaded (SAE dryseal American Standard Pipe Threads, as described in the SAE Handbook) and so used as to have at least three threads engagement as finished; they should be inserted after coating both male and female members with a litharge-glycerine or other suitable sealer.

F. **Peening repairs:** The use of roundnosed, either hemispherical or semi-cylindrical, peening tools and power hammers for repairs should not be permitted beyond the stage of weepers or seepers where liquid comes through under test pressure at the rate of not over two drops per second. Center punching or chaplets to repair leakage is permissible.

G. **Sealing repairs:** Use of polymerizing resin plus 10% pyrophyllite talc or a high silica, low-alkali silicate sealer is satisfactory for leakers beyond the category of weepers or seepers, where the test water under pressure comes through in a fine misty spray and not in a solid stream.

H. **Rusting repairs:** Sal-ammoniac for rusting up seepers or weepers should be used only by dissolving approximately 10% sal-ammoniac in the pressure leak test water and forcing the sal-ammoniac-water solution into the porous areas under pressure of from 65 to 100 psi. Use of sal-ammoniac should not be permitted for leakers beyond the category of seepers or weepers. Never place sal-ammoniac in castings in high concentration without pressure.

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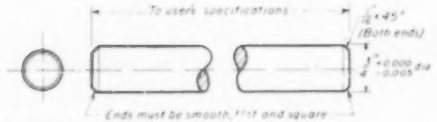
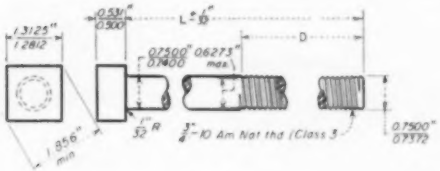
Accessories for OBI Presses



PRESSURE PINS

Material: SAE 1020 cold-drawn steel should be specified for normal service. Where heavy loads are encountered the same SAE 1020 steel should be carburized to 0.050 to 0.060 in. deep at 1650 F to 1700 F, cooled in box, then reheated to 1450 F, quenched in water to harden, after which pins should be tempered at 350 F, for one hour at heat. This will give a surface that is resistant to a file and which is tough enough to stand shock.



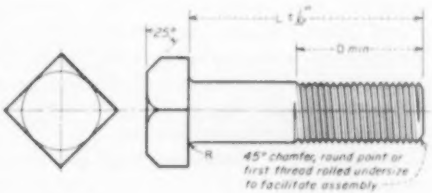
T-SLOT BOLT

(ASA Standard ¾ in.)
Lengths—5, 7, 9, 11 and 13 in.
Thread length D—1¾ in. minimum; 1 15/16 in. maximum.
Finish—Plain

MOUNTING BOLTS

Material:

When tested in tension, bolt must show yield strength of not less than 130,000 psi, and ultimate strength of not less than 149,000 psi. Must be made from fine-grain steel; heated, quenched in oil and tempered to 302-352 Bhn.



MOUNTING BOLTS

Nominal Size	¾	1	1¼
Maximum body dia	0.7500	1.0000	1.2500
Minimum body dia	0.7400	0.9900	1.2400
Nominal head width	1⅛	1½	1⅞
Maximum head width	1.125	1.5000	1.8750
Minimum head width	1.088	1.450	1.812
Min. width across corners	1.494	1.991	2.489
Nominal head thickness	½	21/32	27/32
Maximum head thickness	0.524	0.684	0.876
Minimum head thickness	0.476	0.628	0.812
Maximum radius, R	1/16	⅛	⅛
Threads per inch	10	8	7
Maximum pitch dia*	0.6832	0.9168	1.1550
Minimum pitch dia*	0.6773	0.9100	1.1476
Basic pitch dia*	0.6850	0.9188	1.1572
Minimum full thread length	2¼	3	¾

*The maximum and minimum pitch diameter limits apply to plain-finish bolts.

PART: Antennae stud of 1¼-inch diameter Type 303 stainless steel bar stock.

OPERATION: Chasing bottoming thread, ⅜" x 24.

EQUIPMENT: Geometric self-opening die head.

PROBLEM: Poor finish.

A shop was having trouble with poor finish on threads. In order to bring the thread as close to the bottom of the stud as possible, most of the lead had been eliminated by grinding back the chasers, as shown in (1) Original Set-Up. It seemed as though it would be impossible to get both a well-bottomed thread and a clean one.

"Stainless Sam," Armco's machining specialist, was called in.

HOW PROBLEM WAS SOLVED:

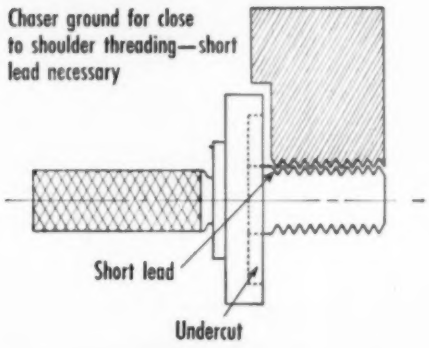
Stainless Sam knew that a 1½- to 3-thread lead on the chasers was needed to assure clean threads and economical operation. He also found that the shoulder was well undercut. Yet the chasers were not ground to take advantage of this favorable design.

So Stainless Sam took a new set of chasers and ground clearance grooves in them as shown in (2) Modified Set-Up. The standard lead was retained and the threads came out clean as a whistle, well bottomed.

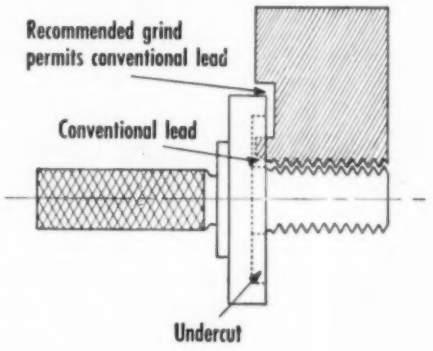
• • •

Almost all machining problems have their answers. Many of them are discussed at length in Armco's latest edition of the booklet, "Machining of Armco Stainless Steels." Write for your copy today. The speeds, feeds and tooling recommended will help you machine stainless steel readily with standard equipment.

(1) ORIGINAL SET-UP



(2) MODIFIED SET-UP



ARMCO STEEL CORPORATION

4522 Curtis Street, Middletown, Ohio • Sales offices and Distributors from coast to coast • Export: The Armco International Corporation

TALKING SHOP

Hey, Weather Man!

DURING the recent heat spell, we were interested to learn that weather records are important in selecting plant location, and that smart companies rely heavily on US Weather Bureau advice. For example, high-carbon steel can be produced most efficiently in areas where temperature ranges are narrow. Wide swings in temperature or humidity during cooling of the steel vary structure and qualities—and customers yell. Such industries as paint and varnish and glass shun highly variable areas. Smart food producers try to avoid areas where heavy static electricity interferes with packaging. And so on.

Seems New York City has some of the most unpredictable weather in the country—which may explain some of the variations in our temper and in our metal (or mettle, for a pun). But our economists say that theories that weather affects business cycles are pure hokum, as are theories that weather follows any multi-year cyclical pattern. We thought you'd want to know.

Century

THE AMERICAN SOCIETY OF TOOL ENGINEERS will charter its 100th chapter at Athol, Mass., Oct 14, thus marking its 20th anniversary. Total membership is now over 22,000. Guests and members will visit L S Starrett and Union Twist Drill. The new chapter will have 109 members, headed by Dr W R Frazer as protem chairman.

Pianist-to-be

IN A LARGE PLANT, the industrial relations director has for years developed aptitude tests that have proved very successful in placing workers. Recently, he found a young Negro girl who has perfect dexterity in all fingers (and toes, too—believe it or not). So he put her on a 2-hand assembly job and later proudly pointed out her performance to a visitor. Said the visitor: "That girl has great gifts. She is doing a great job for you. It seems to me that your company could do something for this girl over and beyond giving her a job and a paycheck. Give her piano lessons at company expense!" After the IR director got over the shock, he did just that. And the girl is making tremendous progress, because very few pianists even get truly perfect dexterity after long years of training and practice.

Plastic Jig Better

REDUCTION in tooling costs, labor, and in use of strategic metals is resulting from intensive use of plastics in production tooling at Boeing. The plastic shop at the Seattle plant has grown (in the past year) from a one-man operation using five gallons of resin a month to an 18-man shop using 800 gallons, and it promises to continue growing as the dollars-and-cents value of plastics in tooling asserts itself further. One plastic tool proving better and more economical than its metal forebears is a metal-bonding jig, a large tool which makes possible the fixing of stress members to aircraft skin with an adhesive. Previously, rivets and spotwelds did the job, with unavoidable distortion of aerodynamic surfaces. This plastic jig, developed in the past year, is considerably lighter than the old-style jig and has added advantages in simplicity of design and manufacture. Savings per jig are figured at about $3,000.

Sample by Tube

WHEN LATROBE STEEL Co had its recent press conference, one of our associate editors was shown the new metallurgical laboratory. It had all the latest equipment, spectrographic, metallurgical and otherwise, was fully air-conditioned, properly lighted. All the editor could think of to say was, "All you need now is a pneumatic tube to bring samples from the mill."

Wordlessly, his host took him into the next room, where workmen were putting the finishing touches on a pneumatic tube for just that purpose.

Who Elects Whom?

MANAGEMENT MEN and prominent people are frequently first to cry that "leading citizens" do not vote. Here is confirmation from a survey in 1948 (after the election) by the executive secretary of the Ohio State Medical Assn:

- 18% of the doctors in one didn't vote
- 22% of their wives didn't
- 10% of Rotary Club members didn't
- 18% of druggists and Kiwanis members didn't
- 11% of teachers didn't
- 32% of bank employees didn't
- 33% of retail grocers didn't
- 21% of Chamber of Commerce members didn't

It is obvious that those who *did* vote are those since courted for their votes.

No Money for Management

AMA HAS JUST RELEASED a study showing that management men are having increasing difficulty in justifying increases—or even in maintaining—their own compensation in the face of rising costs and taxes. Improved profit performance—the usual criterion—requires more than a 25% increase in sales volume because of skyrocketing taxes. Companies that made such increases also increased management compensation in three out of four cases. But those which could not make such increases, even if the picture in general was satisfactory, actually cut management compensation in half the cases. Salaries to top officers increased 5.31% in 1951, but bonuses went down 13% and retirement funds up 11% for a net gain of 2.3%. Meanwhile, average wages to non-supervisory employees went up 9.5%. Pity the poor executive!

News of Metalworking

SMALL TOOLS AND ACCESSORIES were shown in hall 9, which has the largest clear-floor area (120,000 sq ft) of any steel-frame building in Europe. Total show area, 700,000 sq ft, was larger than Chicago machine-tool show in 1947

Hanover Machine-Tool Exhibition Shows Off European Progress

HANOVER, Germany — Something new in international relations was evident at the second European Machine Tool Exhibition, Sept 14 to 23, at Hanover. Instead of being grouped by country of origin, the exhibits were arranged by type of machine, with a small flag on a stand to indicate the nationality of each machine.

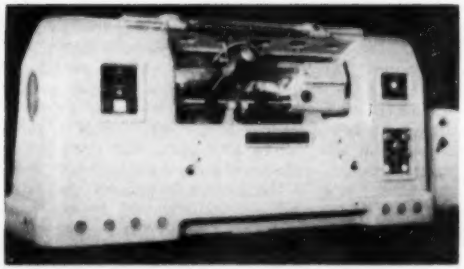
Emphasis was distinctly along the lines of electrical equipment and controls. No less than 160 manufacturers have incorporated electromagnetic clutches for presetting feeds and speeds, automatic rapid approach and return, and similar functions.

Sliding-rotor motors, developed by Demag (Germany) and Brown, Boveri (Switzerland), brake the unit heads of way drills, toolheads of a large planer, automatic chuck of a production lathe, and the electrohydraulic control of a vertical broach. This kind of motor has a conical rotor and stator, and the rotor shaft has axial play and is spring-loaded to close a brake clutch in the end shield of the motor. When current is applied, the conical shape sets up an electromagnetic force, causing the rotor shaft to move axially against the spring, which releases the brake. When power is switched off or fails, the brake is thus applied automatically to stop the motor quickly.

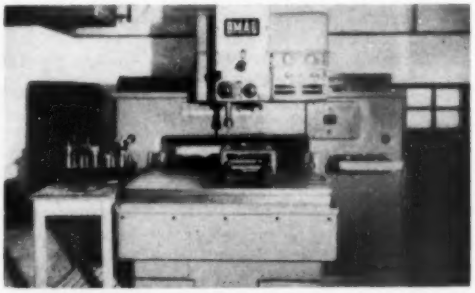
Timing Controls

Siemens-Schuckert (Germany) introduced an interesting program-switching device which predetermines sequence of rapid approach, feed, and rapid return. Setups are made by plugging pegs into a selector plate, and can be recorded for future use by punching holes in a card to match the setup plate. Turret lathes and boring machines were equipped with this device.

A transfer machine for drilling, boring, and reaming distributor holes in four- and six-cylinder engine blocks was shown by Burkhardt and Weber (Germany). The transfer bar is hydraulically operated from a unit at one end of the machine. A control bar from this unit operates the hydraulic controls of the individual heads. Pressure switches and solenoid hydraulic valves sequence the



HEIDENREICH AND HARBECK ELECTRONIC-HYDRAULIC COPYING LATHE (Germany) has self-contained bed and headstocks hung upside down. Copying slide is mounted on long carriage. Capacity is 9.8 in. dia by 49 in. long. Feeds vary up to 19½ ipm, drive is from 40-hp motor. Tool cuts behind the work; bed casting absorbs vibrations



BMAG BORER (Germany) can be set up to coordinated positions automatically without end measurements or optical devices. Indicators work like calculating machine in head. All slides lock hydraulically when spindle is in working position. Accuracy claim is 0.0008 in.

machine movements. Pressure built up in the hydraulic circuit at the end of each movement initiates the next.

Wieck and Heim (Germany) showed a pneumatic superfinishing device that reciprocates the stones at 2500 strokes per min by means of air cylinders, said to be faster than any similar previous equipment. This is an attachment for lathes or grinders. The same company also showed a similar superfinishing machine with continuous feed.

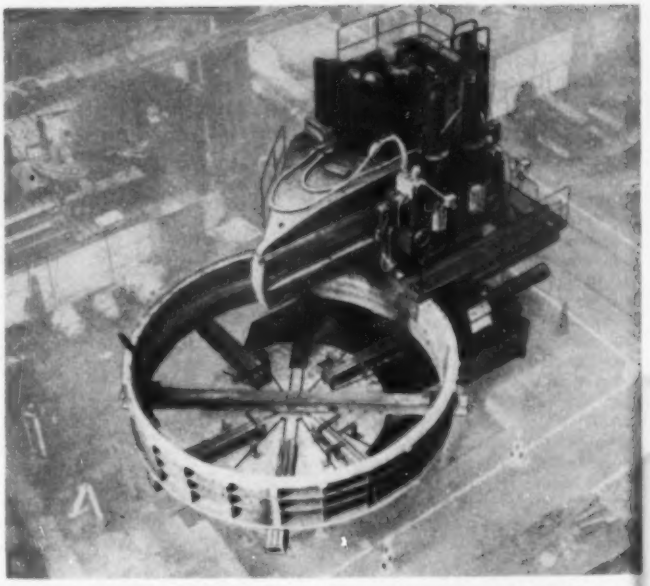
Italy-France

Italian machines revealed advanced design and high quality. Few are copies of existing makes. Machines shown included automatic copying lathes, hydraulic precision grinders (universal, centerless, and vertical surface), gear shapers, horizontal boring machines, radial drills, and production and universal millers.

One of the largest machines shown was an Eustacchio (Italy) double-column vertical boring mill with a 15-ft table. Table speeds range from ½ to 20 rpm, with variable speed control to maintain constant cutting speed as the tools traverse.

Another massive machine was the Berthiez (France) single-column boring machine, weighing 140 tons. The table dia is only 12 ft, but it can handle work up to 23 ft in dia and 10½ ft high. The table displaces horizontally.

Ateliers G S P (France) exhibited several new radial drills, among them an extremely heavy-duty machine with a capacity of 4⅜ in. of steel or 6⅛ in. of cast iron. Head travel is slightly over 10 ft along the arm, which has a new hydraulic lock to fix it to the column. The head has the same lock on the arm.

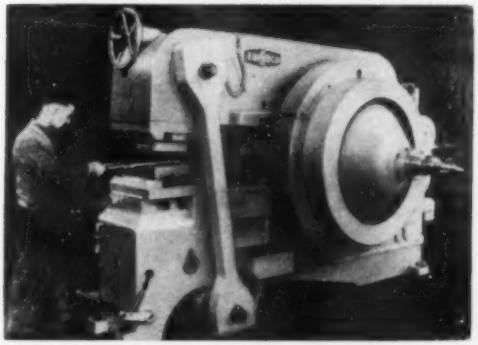


BERTHIEZ BORING AND TURNING MILL (France) handles work to 23 ft in dia on 12-ft-dia displaceable table. One of the largest machines in the show, it has stepless variable speeds and speeds. Tools are set by pushbutton to thousandths

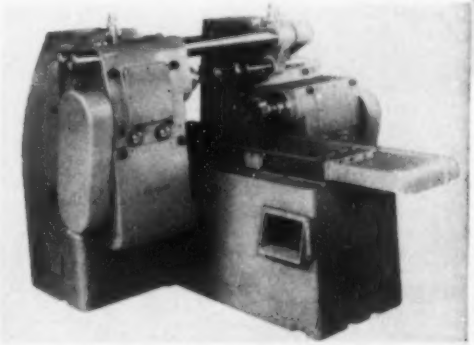
Vertical Beds

Several countries, including Switzerland, France, and Italy, showed profiling lathes with vertical or inclined beds, and Utita (Italy) has extended the vertical-bed idea into a production lathe. Many lathes had indexing dead-stop drums for both longitudinal and transverse saddle motions for quick repeats on multi-dimension work. Many also featured spindle-speed-change controls on the apron and three bearings on the headstock spindle for high rigidity in cutting with carbides.

Turret-head grinders that speed setup changes were another feature. These have wheelheads that index to bring the required spindle into position. Vulkan (Germany) showed a machine with three spindles, one for cylindrical, one for surface, and one for internal work. A grinder by Im-



EUMUCO HORIZONTAL FORGING MACHINE (Germany) has grippers accessible from three sides, dies adjustable and changeable from two sides. Pressure is transmitted through heavy tierods. It has an electro-pneumatic clutch



OLIVETTI FP4 PRODUCTION MILLER (Italy) has unit construction that allows various arrangements for customer requirements. Three bed sizes give table traverse of 19½, 39, or 70 in. Normal feed rate is 31½ ipm, max

HANOVER . . . continued

peria (Belgium), made for working carbides, has four spindles. One has a silicon-carbide wheel for roughing, the second a diamond head for tipping, a third for lapping, and a fourth for cutting the chip breaker.

The new Fortuna grinder maintains constant wheel-edge speed as the diameter decreases during dressing. Stepless speed changes from 3000 to 7000 sfpm and an attachment that permits speed reduction to 300 sfpm for form crushing are features.

Precision boring machines were well represented, many of them designed to apply precision-boring techniques to turning and facing. A semiautomatic by Diedechein (Germany) can be fitted with hydraulic tailstock for longitudinal fine turning, hydraulic copying attachment, and electronic speed control for constant cutting speed when facing. Others, such as the Heller and Lugwigsburger machines, are of unit construction and can be built up multi-spindle and multi-way.

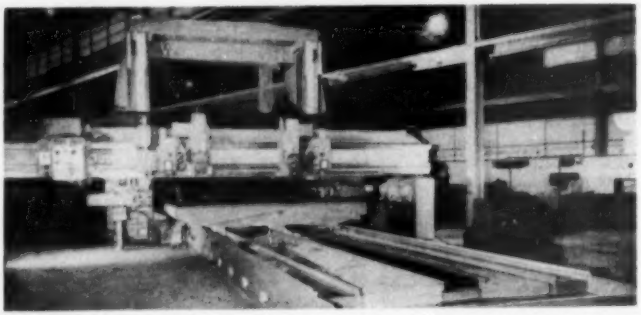
Presses

The trend in press design is toward enclosed moving parts and cleaning up machine outlines. Schuler (Germany) showed three high-speed presses with automatic feeds. One was a 125-ton double-sided model with a speed of 330 strokes per min, another a 25-ton dieing press with stepless variable speeds from 90 to 500 strokes per min, and the third a notching press with speed of 1000 strokes per min.

Two large machines were shown for grinding bed ways; one by Vereinigte Osterreichische Eisen und Stahlwerke (Austria), the other by Ateliers de Construction de Familleureaux (France). The Austrian machine is open-sided with swiveling heads that traverse on the arm to permit longitudinal and cross ways to be ground at one setting. The arm tilts for grinding inclined ways. Largest machine size is 50 tons, capable of grinding a 40-ft way.

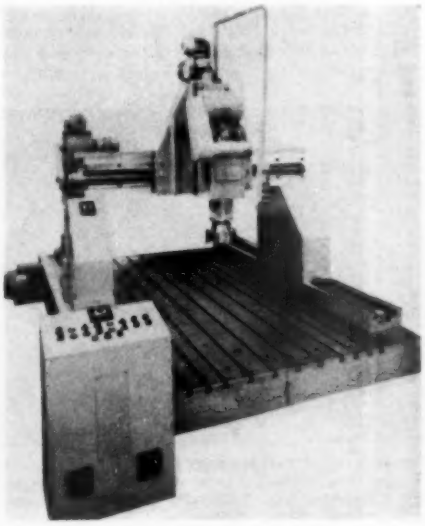
Optical measuring equipment is built into many precision machines. Among the equipment shown by Leitz (Germany) was a projector that reflects an image from an overhead mirror to a table beside the instrument. Lens-turret magnifications are X10, X20, X50, and X100.

Mailfeder (Germany) exhibited the Duromatic hardness tester, which gives direct readings of Notron hardness of grinding wheels. The mechanism has a small chisel point that penetrates to a given depth with a number of counted strokes.

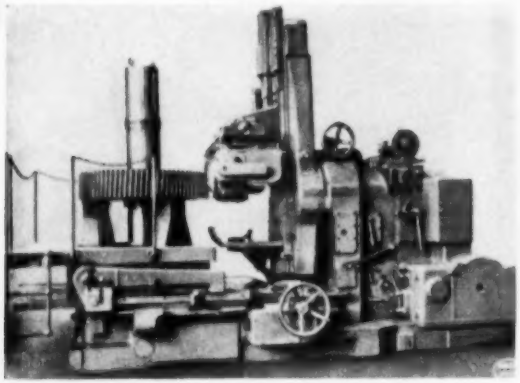


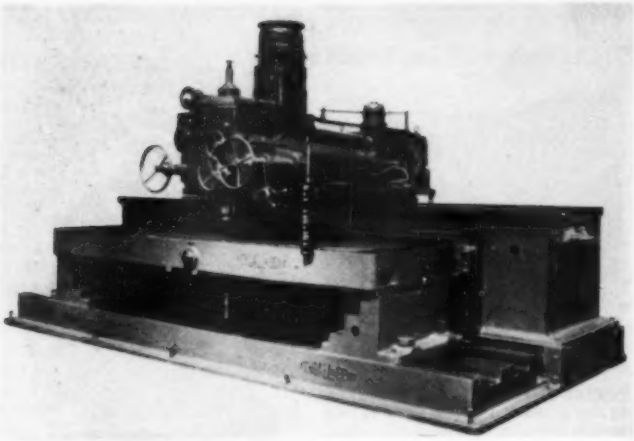
WAGNER PLANER (Germany) weighs over 300 tons, and can cut workpiece of 97 tons, 400-in. length, 180-in. width, and 140-in. height. Sliding faces of table are plastic. Table speeds run up to 195 fpm, toolhead feeds from 0.004 to 1¼ in. per rev, and quick traverse is 60 ipm. Milling head is attached to crossbeam

GEORG BRIDGE-TYPE MILLER (Germany) has 15¾-in.-dia milling head. Overall length is 15 ft, width is 10 ft. Longitudinal spindle travel is 11 ft, 6 in. Cross travel is 8 ft →



MAAG SHS-120 GEAR GRINDER (Switzerland) cuts spur and helical gears to 47 in. in dia and 18 in. wide. Wheelhead has two wheels. Cutting can be done on downstroke or upstroke





TRAVELING-HEAD MILLER by Kendall & Gent (England) has 30-hp, two-speed motor for the spindle, 5-hp motor for feed, and 5-hp for table elevation. Speeds range from 15 to 310 rpm, and feeds run from 2 to 24 ipm. Table is adjustable for height in three steps, and is 12 x 3 ft. Head travel is 13 ft by 3 ft

Olympia Tool Show Includes British And Other European New Models

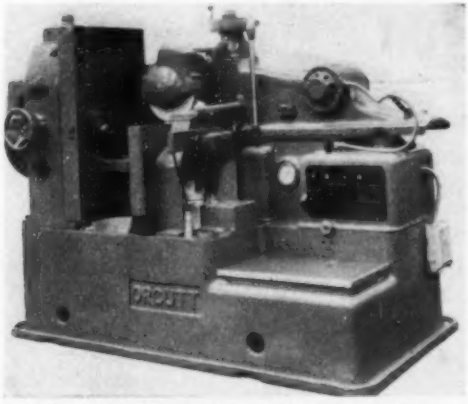
LONDON—This year's International Machine Tool Exhibition at Olympia indicates clearly the advances that have taken place since the previous show, four years ago. Particularly significant is the number of Continental machines shown by British agents, which serves to indicate the rapid revival of the industry.

The regulations governing the Show did not permit non-British builders to exhibit directly, but as most manufacturers have British distributors, the European field was well covered. Countries represented included Germany, Switzerland, Italy, France, Belgium, Sweden, Denmark, Holland, and USA.

Despite national boundries, there was a remarkable similarity between machines of one country and those of another. This applies not merely in externals, but in the general lines of thought of the designers. For example, copying machines were shown by a large number of builders from all countries, and while various systems were introduced—hydraulic, electronic, electric, electronic-hydraulic, and pneumo-hydraulic—it was notable that hydraulic systems predominated. Copying devices were also applied to other machines besides lathes and mills, including boring mills and shapers. Of the latter, an 8-in.-stroke machine and a 72-in. openside shaper were shown.

Automatic sizing to close tolerances was evident on a number of machines, and steplessly variable speeds were commonplace. Preselective speed changers, confined at one time to turret lathes, are now available

WILLIAM J MORGAN, gen mgr, Machine Tool Trades Assn of Great Britain, outlines purpose of International Machine Tool Show to Burnham Finney, editor of American Machinist



ORCUTT GEAR GRINDER featuring full automatic operation and tape control was shown by Gear Grinding Co., Birmingham. Two rows of holes in the tape are followed by electrical tracing fingers. One row controls starting and stopping, the other initiates wheel dressing

ZETTO 30 INTERNAL AND EXTERNAL GRINDER made by Overbeck (Germany) and shown by Elgar (England) has 2-in.-max external capacity, and 3½-in.-max internal capacity. Spindle is driven by silk belt up to 50,000 rpm, by air to 80,000 rpm. A 120,000-rpm spindle can be added

OLYMPIA . . . continued

on many engine lathes, some radial drills, and some other machines.

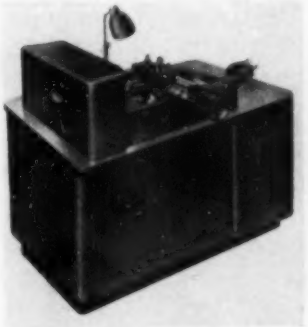
Higher spindle speeds, for carbide turning, were shown on a number of lathes, including a 17-in. British machine with a top speed of 2140 rpm, a French lathe with 3200 rpm, and a 13¾-in. German machine with 3550 rpm. Several American, British, and Continental internal grinders showed high-frequency spindles operating in excess of 100,000 rpm. Particular attention has been paid to lubrication for these high speeds. One particular innovation was water cooling for lathe bearings. A new development in oil-mist lubrication reduces the oil to particles two microns in size.

A new process for cutting long screwthreads was demonstrated on the Waldrich-Coburg (German), machine, which will produce threads up to 2½ in. in dia and 117 in. long. The thread is cut by a six-blade rotating cutter head with progressively set carbide tools. The head is set eccentrically to the work to cut on one side of the shaft, and rotates at high speeds up to 5900 fpm. The work rotates slowly and the head is traversed by a leadscrew. The process is known as Threadwhirling.

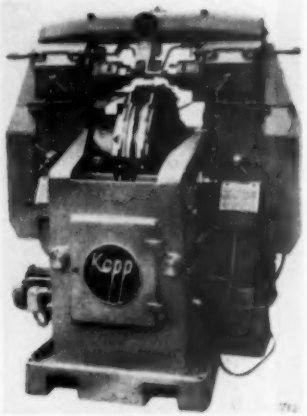
Metalclad, Ltd, introduced a fusion bandsaw running at a speed of 10,000 fpm. The material is plasticized ahead of the cutting edge, but the band itself is cooled by its rapid passage through the air. Armor plate 1¾ in. thick, 60-ton tensile, was cut at 3 ipm. It was claimed that any hard material could be cut provided the melting point was not above 2500 C.

A new Matrix large-capacity thread grinder was shown by Coventry Tool and Gauge Co. Unusual feature of the machine is that the table is stationary and the wheelhead traverses. It has a capacity of 6 ft between centers, and can grind up to 14½ in. dia, 6-in. lead.

For preparing large-dia bars for copy turning, two British, one American, and one German machines were shown. All incorporated milling heads for facing bar ends, as well as drill spindles for centering.



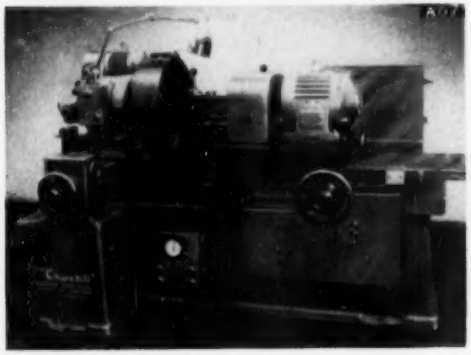
THREAD-CHASING LATHE by Taylor, Taylor & Hobson (England) will hold plain or threaded diameters and lengths to 0.001 in. Chasing is done by reciprocating the workhead relative to a fixed chaser under control of a master screw. Capacity is 6 in. dia, 3 in. long. Speed is up to 2000 rpm

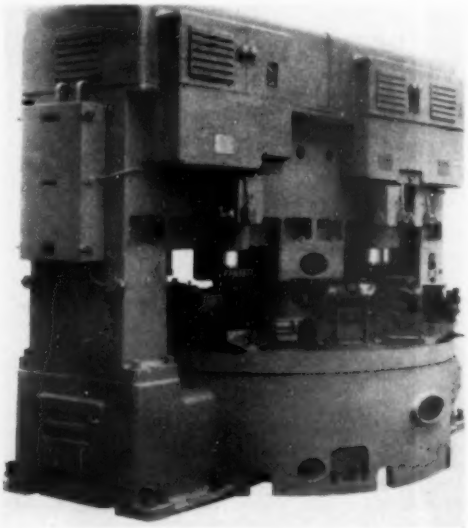


KOPP AUTOMATIC COPY MILLING MACHINE (Germany) shown by Wickman has a continuously rotating workholder drum and copying attachment. Machine has twin, opposed spindles, and accuracy is said to be within 0.0008 in. Control cam is carried on the drum. Quick traverse between work stations reduces idle time

CONTINUOUS ROTARY MILL, by Wm Asquith Ltd (England) has 9-ft table and six vertical spindles arranged in groups of three; two roughers and one finisher. Machine will remove 72 cu in. of cast iron per min →

AUTO-SIZING INTERNAL GRINDER by Churchill (England) has cross-traversing workhead to provide feed, while wheel spindle passes into the bore on a fixed path. Controls are hydraulic, and workhead slide is mounted on rollers to improve sensitivity. Spindle motor is 5 hp





Ralph Howe Talks to Machine-Tool Distributors

VIRGINIA BEACH, Va—Ralph S Howe, director of the metalworking equipment div, NPA, told members of the American Machine Tool Distributors Association that tax laws need revision to encourage investment in new equipment. The occasion was the annual meeting of AMTDA, September 29-30.

Mr Howe remarked that small- and medium-size businesses are particularly hampered by government regulations that prevent rapid amortization of equipment. Citing some European practices, he urged that fast amortization would help defense work by improving equipment available for production.

Edgar J Siefreat, retiring president of the group, urged continued cooperation of the association members with NPA, and also remarked on the progress made by the training course conducted by the association and by the machine-tool builders in educating sales engineers to adapt the most productive machines to customer requirements.

Swan E Bergstrom spoke at the meeting on the training course, and urged machine-tool sales efforts based on savings in costs and good tool engineering.

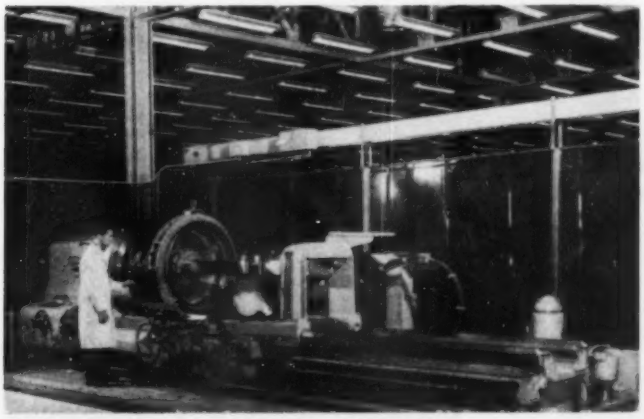
Members elected to office were John M Riordan, Riordan Machinery Co, Detroit, president; E R Motch, Jr, Motch & Merryweather Machinery Co, Cleveland, first vice-president; Thomas R Rudel, Rudel Machinery Co, New York, second vice-president. New members of the executive committee are Spencer B Booz, Federal Machinery Sales Co, Chicago; C Kyrle Raber, State Machinery Co, Indianapolis, for three-year terms; and C J Harter, C J Harter Machinery Co, Houston, for one year.

A V Roe Starts Producing In Canadian Jet Plant

TORONTO—Orenda turbojet engines that will power Canadian-built Sabres and CF-100 Canucks (twin engines) are now coming off the line at a new 10-acre plant that is completely air conditioned. Peak production is scheduled to be reached by the end of 1953, with over 400 subcontractors providing 70% of the engine parts.

The factory is the start of Canadian aircraft-engine industry, and has been established by tapping engineers and machinists from US and England to train operating personnel. Other plants to produce forgings, magnesium castings, fuel systems and controls, machined blades, and roller bearing have also been built.

The Orenda engine will later be installed in the Avro Jetliner, which is also being produced near Toronto.



AMERICAN PACEMAKER LATHE MACHINES COMPRESSOR CASINGS under 22 ft of clear headroom that allows shifting engine parts with jib cranes in A V Roe plant. Air conditioning maintains 75F, fluorescent lights supply 4 to 5 foot-candles at working level. Bus conduits bring in power to any point

NORTON TESTS MATERIALS FOR ROCKET NOZZLES

WORCESTER, Mass. — Four bonded materials show promise for use as heat-resistant rocket nozzles and rocket-chamber liners: Silicon carbide bonded with silicon nitride; Graphite coated with silicon carbide; Refractory carbide, borides, and nitrides; and crystalline oxide coatings.

WILLYS ADAPTS JEEP TO RR INSPECTION JOBS

NEW YORK—A Hy-Rail car made by adding retractable flanged wheels to a jeep is being produced for railroad work; it will replace the usual gasoline putt-putt on 21 US railways. Special models with pickup-truck bodies, telescoping towers, or 11-man cabooses are powered by four-wheel drive and the regular 72-hp engine. Car can switch easily from rails to concrete road.

NAMF SURVEYS EQUIPMENT IN PLATING FIELD

WASHINGTON, D C—National Association of Metal Finishers is surveying the plating industry to compile information on equipment, size, and type of finishing done. Objective: to prove to government bureaus the importance of the industry to mobilization.

USAF SOUND ROOM CHECKS RADIO SIGNALS

DAYTON, O—A sound-proof and echo-free chamber modeled on that at Harvard University has been completed to test communications equipment. Sound-absorbing material and special wedges eliminate reflections of sound waves inside the 25½x27½-x18-ft chamber.

ENGINEERING-COLLEGE ROLLS

CHICAGO — Illinois Institute of Technology has reported the current undergraduate engineering-college enrollment:

Illinois Inst of Tech	1376
Brooklyn Polytechnic	1156
Purdue University	3721
University of Illinois	3102
New York University	1176
College of the City of N.Y.	2151
Massachusetts Inst of Tech	2359
Rensselaer	2858
Georgia Tech	2804
Pennsylvania State	2530

In addition, the four largest enrollments of night and special students are IIT (3765), Brooklyn (2224), NYU (1256), and CCNY (875).

Metalworking Abroad

(By McGraw-Hill World News)

Holland to Make Regulators—In Minneapolis-Honeywell plant to be opened in Amsterdam in January. American parts will be assembled at first, but plans are to switch to Dutch-made parts before long.

Fokker May Reclaim Importance—if US offer to place $29-million order for Supermarine Swifts is matched by $40-million Dutch order. Fokker now has new plant.

Britain Buys More Cycle Cars—which are three-wheeled autos that sell for $800 plus tax. The midgets are being built by English firms, which are expanding production.

S Africa Makes Small Diesel Engine—to power a midget mine locomotive. Power is 15 hp, weight of locomotive is 2½ tons, length is only 4 ft, 9 in. Speed is 4½ mph.

Philippine Embargo Holds War Surplus—that US company wants to bring back for sale here. Electronic equipment and aircraft parts weighing 7000 tons are being held.

England Will Build Huge Miller—for construction firm in Montreal. The open-side miller will be 45 ft long, have electronic controls. Contract is worth $250,000.

France Studies US Forging—and has sent a team to observe methods and equipment. Heavy forging in France has fallen to a quarter of the pre-war level, and big problem is building up for military work.

DPA's Campbell Report Results In Some Quiet Service Scurrying

WASHINGTON—Civilian mobilization officials are claiming a victory in their fight with military brass over aircraft procurement. Early in July DPA's Aircraft Production Board delivered the Campbell report that charged the services with waste and foot-dragging, and recommended that they cut down sharply on model numbers; selecting the best fighter, bomber, etc; and standardize buying.

Navy and Air Force have been publicly playing down the report, claiming that following it would throw the aircraft industry into a complete mess.

But behind the scenes, some of the glaring holes in the services' procurement operations have been undergoing repair:

- Mockup boards,, blasted by the Campbell report, have been streamlined to a dozen or so members.
- A quick procedure has been set up by the Air Force for notifying manufacturers about mockup-board decisions on their designs.
- Engines have not been affected drastically, but Defense Department expediters have been helping to clear up tooling troubles on the British-designed J-65 being built by Curtiss-Wright. The Westinghouse J-40 is apparently ready for production.

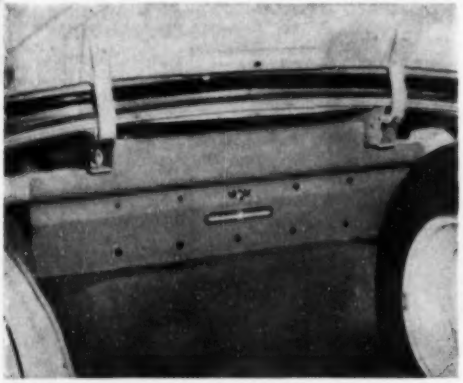
AF and Navy spokesmen still insist they are making no serious changes in buying habits along the lines suggested by APB, but such changes would take a long time to be seen clearly. Civilian mobilizers predict that reductions in numbers of contracts and models to be built will be seen sometime next year. If the civilian mobilizers are right, they will have accomplished something of a miracle in injecting at least a measure of efficiency and economy into the wasteful business of procuring military equipment.

ASA ADOPTS POWER-STAMPING CODE

NEW YORK—American Standard Safety Code for Forging and Hot Metal Stamping, B24.1-1952, gives general requirements for working and aisle space, personnel protection, platform construction, and lighting. The code is a revision of a 1927 edition, and covers drop-forging and flat-die forging, hydraulic presses, and other press-shop equipment.

FORD TEACHES SUPPLIERS QUALITY CONTROL

LOS ANGELES—Four two-day sessions with West Coast suppliers in September indicate that Ford is following a trend toward more use of statistical quality control. Object of the conference was to show suppliers how to gather data, tabulate it, and interpret it to eliminate much extra inspection work.



YOUR 1953 AUTO AIR CONDITIONER WILL LOOK SOMETHING LIKE THIS experimental installation by Frigidaire in an Oldsmobile (left). Compressor pump (right) is located next to the engine. Lines go back to the trunk.

Electrolytic Grinding Cuts Carbides

DETROIT—A new process using an electric circuit between the work and a diamond wheel cuts metals by anodic dissolution—electric current breaks down the work. Key to the process is the electrolytic solution, through which heavy (400 amps per sq in. for carbides, and 1500 amps for steel) current passes.

Work is positive, wheel is negative. The narrow space (0.001 in. or less) between them is maintained by diamond bort in the special wheel, which also scrapes away oxides but doesn't really cut. The electrolyte, which is flooded between wheel and work, contains silicate or aluminate salts. Tool grinding is at least as fast as with a conventional diamond wheel, but utilization of diamond bort is sharply reduced. Electrolyte is replaced between the wheel and work rapidly by running the wheel at normal grinding speed.

The Super Cut Corp development was described at a carbide-section meeting of Detroit's ASTE chapter by L H Metzger, president, and George Keeleric, development engineer, who invented the process for Super Cut. They reported that tests at Ford on carbide tools proved the process works twice as fast as regular diamond grinding, it results in no minute cracks in carbide, and is much cooler. One special result in the process is slight rounded edges on tool tips, which makes dub-off unnecessary.

Norton Co tests of a similar process indicate good results should be expected.

Machines are being built and delivered by Hammond Machinery Builders. Super Cut is developing wheels, and is marketing a conversion kit that adapts regular tool grinders to the process.

Army Big Shot

WASHINGTON—The Army's latest gun is big, fast, and exceptionally lethal. The 170,000-lb weapon can be hauled at 35 mph to deliver an atomic warhead shell on a target 20 miles away.

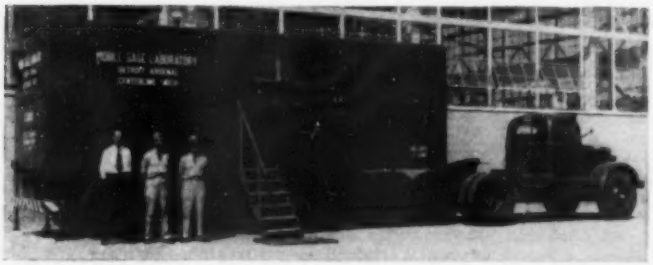
Fire control is provided by latest electronic devices developed at Frankford Arsenal in Philadelphia; the 280-mm projectile can find its target in any kind of weather.

The atomic field piece is the result of three years of combined effort of the Army's manufacturing arsenals. Primary layout and engineering was done by the Franklin Institute; Watervliet made the gun tube; Picatinny developed the ammunition; Detroit Tank Automotive Center worked on the 375-hp transporters, ultimately made by the Kenworth Motor Truck Co of Seattle.

Length of the gun carriage is 38 ft; overall length with the two tractor transporters necessary to haul it is 84 ft. The weapon can fire either atomic or conventional ammunition.

REYNOLDS STRETCHES POTS TO UP ALUMINUM OUTPUT

LONGVIEW, Wash—Capacity of 372 reduction pots was increased from 60 to 100 million lb of pig aluminum per year by adding widening sections to the pots by welding. Electrolytic cells were cut in half, then rewelded with two extra sections each.



MOBILE ARMY GAGE LABORATORY checks instruments at ordnance depots. The six-ton trailer is air-conditioned, and has $30,000 worth of projecting, comparing, and surface-checking equipment. Army plans to make more to service other areas

Mergers—Purchases

Shakeproof will produce fasteners and precision stampings in a new Des Plaines plant.

Twentieth Century Mfg will make small tools in a new plant at Libertyville, Ill.

U S Steel is building at Harrisburg, Pa, to increase prefabricated-housing facilities.

Western Sky Industries is producing AD-5 center wings in a new Hayward, Calif, airport plant.

Westinghouse is making tubes in a new Elmira, NY, plant, and is building a refrigerator plant at Columbus, O.

34th Metal Show Will Be Biggest Yet

PHILADELPHIA—Four hotels (Benjamin Franklin, Bellevue-Stratford, Adelphia, and Sylvania) and Convention Hall will house technical sessions and exhibits of the National Metal Congress and Exposition. Expected attendance is estimated at 50,000. Exhibits of metal production, fabrication, test, and application will number 400.

Societies cooperating with American Society of Metals are American Welding Society, Society for Non-Destructive Testing, and American Institute of Mining and Metallurgical Engineers. The program includes a seminar on methods of research, and sessions on high-temperature phases, hardenability, mechanical properties, and elevated-temperature properties.

BLS Wage Survey Shows Mixed-Up Trend

WASHINGTON—Wage increases in the machinery-manufacturing industry average 55% in the six years after WWII, according to a check of 28 cities by the Bureau of Labor Statistics. Most notable fact found is that there seems to be no regional pattern—top increase of 68.8% was in Pittsburgh, while the smallest was in Seattle, Wash.—only 33.9%.

The big jump was from 1945 to 1946—amounting to 19.5%. Next big rise was in 1950-1951, when Korea defense jacked wages 7.5%.

Another important fact is that the low end of the payrolls took larger humps than the upper, partly because of across-the-board wage increases. Truckers gained 66%, while tool and die makers got 45%.

Robert L Holt

Wilbur Gardner

H Pagels

Charles T Zaoral

Names in the News

Robert L Holt has been named vice president of Bowser, Inc, Fort Wayne, Ind. Prior to his appointment, Mr Holt was vice president of H M Byllesby & Co of Chicago. He will continue as vice president and director of the Pacific & Atlantic Shippers Association, a position he has held for the past 15 years.

R C W Peterson, Peterson Engrg Co, Toledo, Ohio, has been awarded a certificate of service by the American Standards Association. Mr Peterson, who represents the American Society of Tool Engineers on the ASA Standards Council, has been especially active as secretary of the committee on Classification of Materials for Tools, Fixtures, and Gages, B52.

E Carl Hanks has been appointed chief, Mechanical Power Transmission Branch, General Components Div of the National Production Authority. Mr Hanks is on leave from the Westinghouse Electric Corp of Pittsburgh, where he is assistant sales manager of the Gearing Div. He succeeds **Harold I Markey,** who has returned to the Diamond Chain Co, where he is manager of the eastern sales office in Philadelphia.

Jerry G Wilson has been named engine sales supervisor in the sales development division at Caterpillar Tractor Co. Before joining the firm two years ago, Mr Wilson was associated with Nordberg Mfg Co, and Fairbanks, Morse. **Robert F White** has been named western division parts representative, with headquarters in San Leandro, Calif. **W C van Dyck** has been advanced to assistant manager of education and training.

Wilbur Gardner, secretary and treasurer of DeWalt, Inc, has been elected a vice president of the power cutting tool manufacturing subsidiary of American Machine & Foundry Co.

H Pagels has been appointed vice president in charge of manufacturing, American Engrg Co, Philadelphia. He has been serving as works manager since 1945. **F C Messaros** has been named vice president, engineering; he has been associated with the company for 25 years, and since 1946 has been chief engineer in charge of power plant, marine, fluid power, and materials - handling products.

Harry A Carlberg has been appointed manager of plant engineering in the General Electric Co's manufacturing department at Hanford Works, Richland, Wash. Mr Carlberg has been associated with Hanford since 1943.

Leland E Coulter has been named general manager of R-B interchangeable punch and die activities at Allied Products Corp's expanded Hillsdale, Mich, plant. **Peter C Fortune** has been transferred from Chicago to assist Mr Coulter. **William Reece** has been appointed to head sales in the Chicago territory, and **Raymond E Wilds** has been named assistant sales manager of R-B products.

George B Moseley has been appointed general sales manager of Firestone Steel Products Co. Prior to joining the organization in 1949, Mr Moseley was sales manager for Contract Mfg Co.

Charles T Zaoral has been appointed vice president in charge of operations, New York Air Brake Co. Mr Zaoral for the past seven years has been general manager of the international division of Bendix Aviation Corp, and a director of its subsidiaries in Canada and Australia. **Lewis K Silicox,** formerly executive vice president, has been elected vice chairman of the board. **Robert G Hess,** formerly president of the company's subsidiary, Kinney Mfg Co, has been named manager of Air Brake's main division at Watertown, N Y. **R H Mitchell,** formerly assistant to the executive vice president, succeeds Mr Hess. **Frederic W Hewes,** treasurer and assistant to the president of the parent company, has been elected vice president in charge of finance.

Harlan Knox Perrill has been named manager, engine division, Burbank, Pacific Airmotive Corp. He succeeds **L B Littrell,** appointed general manager, aircraft operations. Mr Perrill was formerly associated with Solar Aircraft, Convair, and Hughes Aircraft.

Ray C Wright has been appointed sales manager of Stronghold Pacific Corp, Los Angeles. Prior to joining the company in July 1951, Mr Wright was associated with Fibre & Metal Products Co, and RIVCO, Inc.

William J Kingsley has been appointed assistant general sales manager of the Carborundum Co. A member of the organization since 1922, Mr Kingsley has most recently been connected with the sales staff of the bonded products and grain division. **Fred W Scott, Jr,** has been named manager of the newly-established merchandising sales division. He was formerly sales manager for coated products.

William L Batt

C R Boll, Jr

Walter L Smith

Dr Samuel S Kistler

William L Batt, minister in charge of the Economic Cooperation Administration mission to the United Kingdom, and former president of SKF Industries, Inc, has been awarded the Howard Coonley Medal for distinguished service in the standardization movement. Mr Batt is widely known for his important service to the international standardization of screw threads.

W E Watson has been promoted to assistant to the manager of manufacturing, Fairbanks, Morse Co, Chicago. For the past several years Mr Watson has been serving as manager of the Pump Mfg Div. **Paul R Flood** has been appointed general manager of the company's Pomona, Calif, pump works, succeeding **Charles L Barrett,** who has become a division consultant. **Lewis H Kessler** has been named chief hydraulic engineer at the company's Beloit, Wis, works. **Robert B Craig** has been appointed assistant to the president, working on special assignment in the firm's Washington headquarters.

Norman Dirks has joined Modern Steel Treating Co, Chicago, as technical director in charge of all manufacturing operations, plus developments and laboratory research. Mr Dirks has been chief metallurgist at Perfection Tool & Metal Heat Treating Co since 1947.

Wallace F Ardussi, president, Variety Machine & Stamping Co, Cleveland, has been elected president of the Pressed Metal Institute. **Samuel P Hull,** sales manager, Worcester Stamped Metal Co, Worcester, Mass, was elected vice president, and **Hunter Morrison, Jr,** vice president, Morrison Products, Inc, Cleveland, is new secretary and treasurer.

C R Boll, Jr, has been appointed general sales manager, Cummins Engine Co, Columbus, Ind. Mr Boll joined Cummins in 1941, and since 1948 has been serving as manager of engine sales. **C B Foster,** formerly manager of contract sales, has been appointed to the newly-created position of sales manager, engines. He will continue to be in charge of all government contract work.

Walter L Smith has been elected vice president in charge of operations and a director of Chase Brass & Copper Co, Waterbury, Conn. Mr Smith, who joined Chase in 1915, has been serving as works manager for the Chase Metal Works at Waterbury since 1946.

Dr Samuel S Kistler, internationally-known authority on abrasives, has been appointed research associate of the Peninsular Grinding Wheel Co, Detroit. Dr Kistler resigned recently as director of research for the Norton Co, with whom he had been associated since 1935, to accept the deanship of the University of Utah college of engineering.

Arthur Kelly has been named vice president, manufacturing, B F Goodrich Co, following the retirement of **Thornton G Graham,** effective January 31, 1953. Mr Kelly, a member of the firm since 1925, is presently serving as general manager of industrial and aeronautical products manufacturing.

OBITUARIES

Clarence E Bleicher

Clarance E Bleicher, 62, president and general manager of DeSoto Div, Chrysler Corp, died Sept 23 in Detroit. Mr Bleicher joined Chrysler in 1924 as tool supervisor in Dayton. He became vice president and general manager of DeSoto in 1937. He took over management of Chrysler's Los Angeles plant in 1942, in addition to his work at DeSoto, supervising production of Army and Navy bomber assemblies. In 1944, he was named president of DeSoto, first time in the division's history that one man had held the office of both president and general manager.

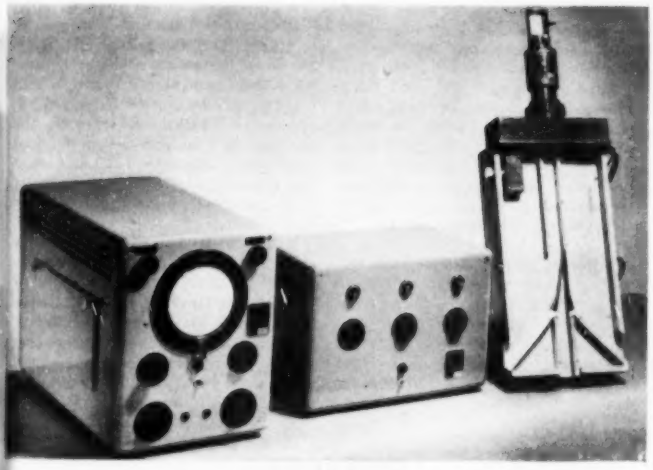
Sanford Stephenson, 55, manager of wire and wire products for Bethlehem Pacific Coast Steel Corp, died Aug 18 in Burlingame, Calif. Prior to joining Bethlehem in 1935, Mr Stephenson had been associated with Pittsburgh Steel Co, Los Angeles.

Paul B Greenawald, 58, vice president, production, and a director of the Carpenter Steel Co, Reading, Pa, died Sept 4 in Reading. Mr Greenawald had been a member of the organization since 1924, and in 1945 took over the position he held at the time of his death.

Moritz O Kopperl, 51, executive vice president of the Edgcomb Steel Corp, Hillside, NJ, died Aug 31 at Laconia, NH.

SHOW IN PRINT

Products shown in this section have not been described previously in our pages. They will be exhibited at the National Metal Congress and Exposition Convention Halls, Philadelphia, October 20-24



Test Instruments Operate By Inductive Pick-Ups, Coils

A complete range of electronic test instruments have been developed which operate by inductive pick-ups or coils to test for size, defects, material conductivity, to segregate between alloys, and a number of other sorting or classifying functions.

There are many basically different instruments within the Magnatest group and many size and type differences for each instrument. Some of the instruments are engineered for specific jobs that will be handled fully automatically, while others are general-purpose units.

The **FM-100** is a flexible unit which instantaneously reads the conductivity for any non-magnetic material when the pick-up coil is held against the metal. This instrument is useful, for example, in sorting mixed alloys, in evaluating contamination in electrical conducting metals, and for evaluation of hardness of age-hardening metals.

The **FS-200** permits high-speed sorting of small parts by variations of hardness, size, or because of the presence of cracks. Parts are dropped through the coil at several thousand per hour, and the instrument is adjusted to sort them in three groups.

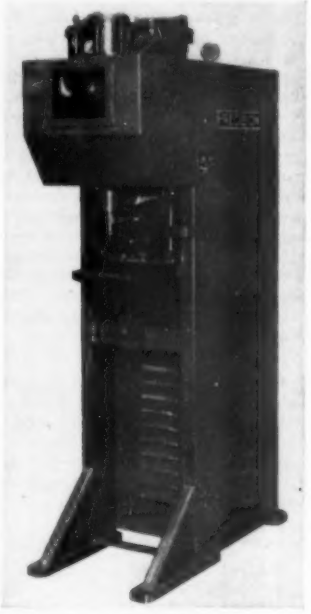
Magnaflux Corp, 5900 Northwest Highway, Chicago 31, Ill.

Three-piece gear motor, with easy maintenance features, is equipped with a stator that can be removed and replaced in half the time formerly necessary. KRX totally-enclosed, high-torque, high-slip punch-press motor has an extended bar rotor design which improves cooling and reduces size for hp.

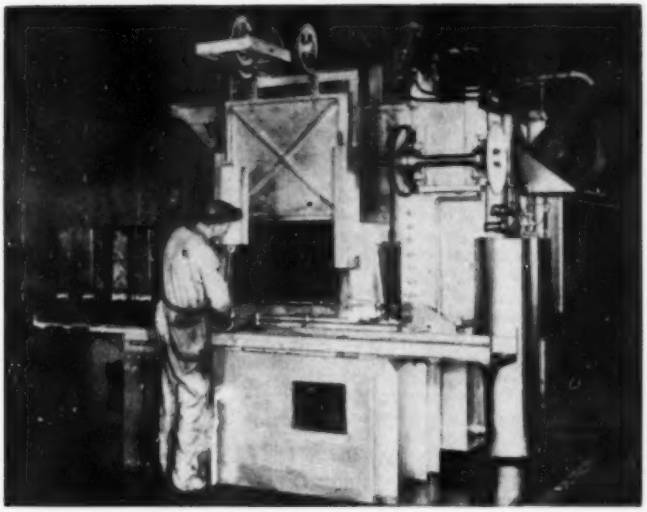
General Electric Co. Schenectady

Three new dressers are available in a standard line. First is a cluster set in a high-chromium-titanium bond. The second is a J & L thread-grinder dresser set in the same bond. It is claimed the diamonds will not work loose unless a great deal of setting has been ground away. The third is a diamond boring bar for the turning and boring of cemented carbides.

National Diamond Laboratory, 108 Fulton St, New York 38, N. Y.



MAGNETIC HEAD WELDER provides a direct relationship between current and pressure, thereby obtaining good welds in critical applications such as electrical contact welding, aluminum crosswire welding and many others. ***—Precision Welder and Flexopress Corp., 138 E. McMicken Ave., Cincinnati 10, Ohio***

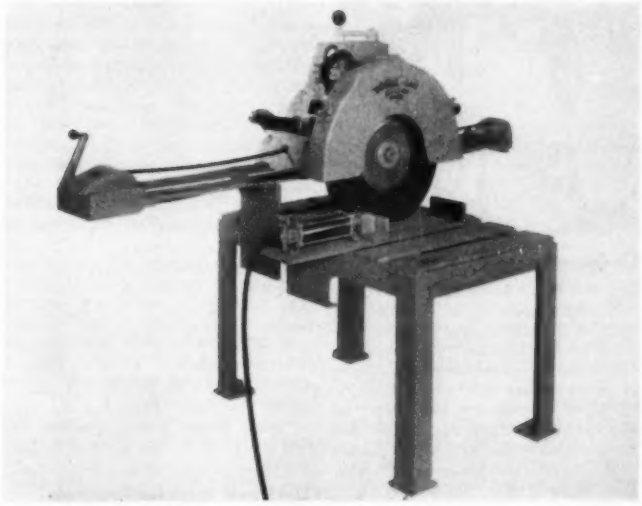


Versatile Batch Furnace For High-Production Heat-Treating

This batch furnace is capable of case and homogeneous carburizing, dry cyaniding, clean hardening, and carbon restoration at high production rates.

It is available in two capacities—500 and 1600 lb per hr. gross. The operating temperature range is 1450 to 1750 F utilizing radiant-tube heating elements and a forced-convection recirculating fan. A special enclosed quench chamber permits rapid, direct quench under controlled-atmosphere conditions.

Surface Combustion Corp, Toledo, Ohio



WORKTABLE for the Stone Model-SS20 cutting machine provides a complete setup assembly. The assembly can be used for almost any metal-cutting application such as cutting structurals, bars, pipe, and tubing. The hand-crank feed and air-activated vise speed up the cutting.—*Stone Machinery Co., Manlius, N.Y.*

Radiation-temperature detector permits sighting between coils of an induction heater to measure temperature of the work itself. It makes possible more uniform process control with resultant better product quality. It has extreme sensitivity to temperature change—99% of final reading in 0.6 of a second after instantaneous change. Known as the Rayotube, it can sight on a target only 0.1 in. in diameter from a distance of 4 inches.

Leeds & Northrop Co, 4907 Stenton Ave, Philadelphia 44, Pa.

Hand-Operated Bender for Up to 12-In.-Radius Curves

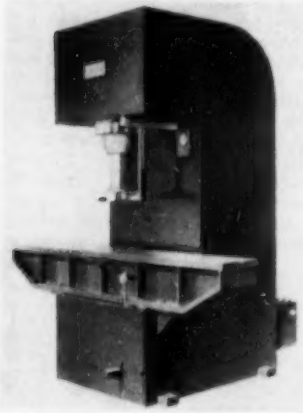
Hand-operated bending machine has a capacity of up to 1-in.-dia cold-finished steel bar and 1¼-in. tubing or their equivalents. Designated Di-Acro Bender No. 4, it is designed for heavy bending where production does not warrant a power-driven machine. It offers a radius bending range from 0 to 12 in.

A built-in ratchet mechanism can be engaged or disengaged by the operator depending upon the size of the material being formed. Engaging the mechanism increases the material capacity of the bender—larger and heavier size material can be bent—and increases the mechanical advantage four times.

By disengaging the ratchet—operating the bender in direct drive—the operator can step up the production of lighter materials.

The bender can be quickly changed over from one forming operation to another. A special stand is available, as is a complete line of accessories for bending tubing, angle, chanel, extrusions, moldings, strip stock, etc.

O'Neil-Irwin Mfg Co, Lake City, Minn.



Dake Hydraulic Air Presses For Forcing or Straightening

A complete line of hydraulic air presses for forcing and straightening operations are available in eleven standard forcing models, and eleven standard straightening models—with capacities ranging from 15 to 300 tons. They are electric powered.

The straightening presses have a self-contained power unit and adjustable stroke control for both directions of stroke. A combined hand and foot lever provides sensitivity which permits the operator to apply any pressure up to maximum by increasing pressure on the control valve.

The forcing presses have a two-speed ram advance and extra-large table. The stroke can be preset for both directions by an adjustable-stroke limit cam. Semiautomatic or automatic cycling can be provided at slight extra cost.

Dake Engine Co., Grand Haven, Mich.

Dye-Penetrant Inspection From Triggered Spray Cans

Spotcheck is a dye-penetrant inspection method for locating surface defects in metals, ceramics, plastics, and other solids.

It is easy to use, just press the trigger on the can. The sealed spray cans provide their own pressure. There are no pumps, hose lines, spray guns, dye brushes, or stained hands.

The method locates defects invisible to the unaided eye and marks them right on the part or material. It is more sensitive than "oil and whiting," "ringing," or usual visual inspection. A prime use would be in low-volume sampling inspection to eliminate the cause of defects.

There are four steps involved in its use:

(1) Spray Spotcheck cleaner on dirty surfaces and wipe well.

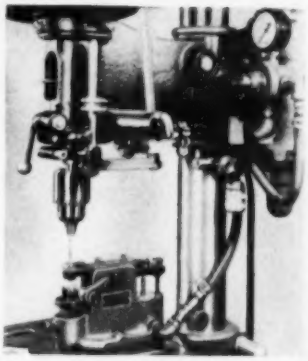
(2) Spray penetrant. Bright red liquid is drawn or dissolves its way into defect.

(3) Spray on cleaner and wipe away excess penetrant. On smooth surfaces wiping without cleaner suffices.

(4) Brush on developer. Goes on easily in a smooth, even coat to draw out penetrant.

(5) Inspect for defects which appear as bright-red lines.

Magnaflux Corp, 5900 Northwest Highway, Chicago 31, Ill.

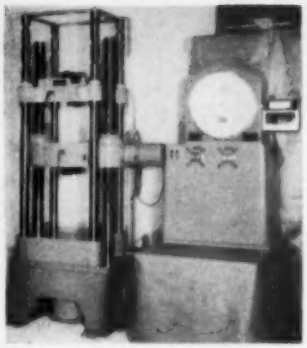


Air-Operated Drill Jig

The Por-Matic air-operated drill jig will handle work up to 1 in. dia. The body of the fixture is secured to the table of any regular ½-in.-capacity drillpress. By installation of a simple valve requiring two tapped holes to mount it, the fixture is then opened and closed automatically by the vertical motion of the drillpress spindle.

The fixture will accommodate drill sizes up to 5/16 in. dia and will permit changing its setup from one job to another, using only the fingers and one Allen key wrench.

Porter Precision Products, PO Box 59, Cincinati 31, Ohio



Loading Unit, Weighing System Independent on Universal Tester

The DeLuxe Super-L hydraulic universal testing machine has been developed as a companion machine to the standard Super L, for those who desire a universal capable of handling much larger specimens with the same accuracy. In addition, many other features are incorporated in the DeLuxe models—built in capacities of 60,000, 120,000, 200,000, 300,000, 400,000, 500,000 and 600,000 lb.

Some of these features are: split cabinet design—the loading unit and weighing system are independent of each other—no impact or shock transfer is possible; 30-in. clearance between screws for easy working with large specimens; rugged four-column construction to provide rigidity for off-center loads and high columns; upper crosshead easily positioned to handle various sizes and lengths of test specimens; lower crosshead furnished with separate motorized control with additional controls mounted on crosshead; and increased stroke length which, added to higher column, provides added length of specimens that can be tested.

Standard features include indirect lighting of Selector-range-indicator dial numbers in addition to regular three-color lighting of load ranges; and simplified valve arrangement whereby operator merely flips a switch to change ranges. One lever operates the machine.

Tinius Olsen Testing Machine Co, Easton Road, Willow Grove, Pa.

Electronic Recorder Produces Stress-Strain Curves on Drum

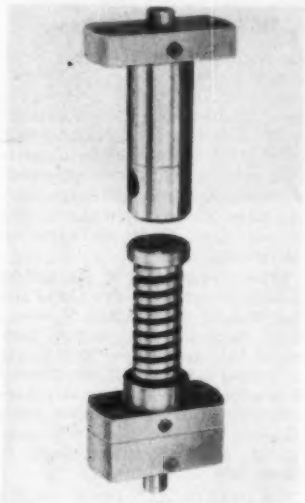
The Model 51 electronic recorder produces stress-strain curves in tension, compression, and transverse test-

ing. It automatically follows increasing and decreasing stresses and strains. It can be used on all types of testing machines and is available in metric units.

An electronically-controlled null balancing system, which is built into the housing, rotates the recorded chart drum in direct proportion to the strain of the specimen under test. The testing machine produces the stress coordinate by horizontal movement of a pen. Calibration is based entirely upon factory-sealed, fixed linear distances.

Standard instruments are available for motion detectors from 1000-to-1 to 1-to-1. Magnifications can be changed by switching without any gear changes required.

Tinius Olsen Testing Machine Co, Easton Road, Willow Grove, Pa.



Punch, Die, and Stripper Combined into Two-Piece Unit

By combining punch, die, and stripper into a two-piece unit which can be readily fastened to any plate press or pressbrake, it is possible to handle short-run punching jobs without the use of die sets or other high-cost methods.

Known as the AC, the unit features a due-button assembly which allows compressed air to blast the punched slug out of the die with each stroke of the press or brake. The punch unit contains its own built-in stripper spring.

Equipped with a ⅜-in.-dia pilot, the unit can be quickly aligned.

Porter Precision Products Co, PO Box 99, Cincinnati 31, Ohio

Solvent cleaner known as No. 28 will remove, by spray or immersion, light oil and grease deposits, stamping inks from steel and aluminum, and many other kinds of dirt deposits. The aircraft industry uses it as a cleaner preparatory to aluminum welding. It is claimed to be: non-flammable, non-toxic, nor-explosive. No special tanks or equipment are required to hold it.

Kelite Products, Inc, PO Box 2917 Terminal Annex, Los Angeles 54, Calif.

Lincoln AC Welding Machine

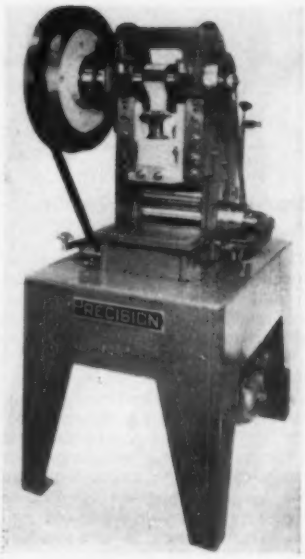
AC welding machines in 300, 400, and 500-ampere capacity complete the Lincoln line of 60, 180, and 200-amp machines. The new design replaces previous 300- and 500-amp machines, and incorporates new features as well as mechanical changes.

A more compact design has the same high output and overload capacity, and incorporates the arc-booster circuit. The large amperage dial is illuminated by an accessible 6-v lamp. A geared crank makes easy and smooth setting of amperage.

All electrical and mechanical control parts required for connecting or that need maintenance are accessible without removing the case. Reconnection of the input circuit for 220 or 440 v can be done without replacing any coils.

A down-draft ventilation system brings air in from the top of the case, circulates it by baffles through the windings and prevents any air from being recirculated. The large lift bale on top of the case accommodates a standard crane hook, thus making the unit easily portable.

The Lincoln Electric Co, Cleveland 17, Ohio



Integral Feed Rolls on High-Speed Punch Press

Material feeds from rear to front through integral feed rolls on this high-speed automatic press. It is only 7 in. from the rolls to the center line of dies. The rolls are infinitely adjustable for all stock advances between 0 and 9 in. per stroke. Adjustable cam control makes possible instantaneous release of roll pressure on material for positioning by pilots on multistage dies. This integral mechanism is said to outproduce all attachments for automatic feed.

The pin clutch engages hardened steel inserts in the flywheel with the brake automatically released when clutch is engaged. The press is put into operation, either single stroke or automatic, by a single trip lever. This lever is duplicated at the rear of the machine for operating from this position. A locking device at both positions controls automatic operation.

The ram is a high-strength light alloy fitted with hardened-and-ground steel raceways operating on ball bearings. Speed is infinitely variable from 150 to 600 strokes per min. This is accomplished by a 1½-hp motor through a mechanical variable-speed drive. A hinge-mounted shaft automatically eliminates any need for belt adjustment.

Capacities are from 2 to 50 tons.

Precision Welder and Flexopress Corp., 138 E. McMicken Ave., Cincinnati

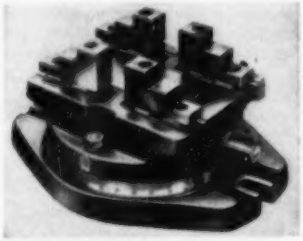
Sheet-Metal Drawing Qualities Tested Non-Destructively

The Model B-1 Flex-Tester performs a non-destructive test on sheet metal to determine its comparative drawing qualities, and its stretch-strain characteristics.

The tester bends a corner of a sheet through a standard arc, measuring on a dial indicator the resistance of the steel to the operation. The test procedure is set up using a 0.035 in. thickness as standard. A conversion device, furnished with the tester, enables the operator to easily convert dial readings obtained on different gages to this standard for the purposes of comparison.

The instrument is not recommended or calibrated for heavier thicknesses than 0.050 in. Research has shown that a flex value in the low 50 range indicates the best drawing. As test values become progressively higher, the drawability of a material gradually decreases. However, it is intended that each user will establish his own standards for various drawing jobs by checking results obtained on the press against tests.

Steel City Testing Machines, Inc, 8845 Livernois Ave, Detroit 4, Mich.



Microtrue Machine Vises Reduce Jigs and Fixtures

Horizontal swivel and universal vises eliminate the need for many jigs and fixtures, reduce setup time, and allow free access to the work.

A wide variety of settings is available through combinations of interchangeable steps and solid jaws. Accesories available for the vise include hydraulically equalized finger jaws, magnetic chuck plate, T-slot plate, and three-jaw lathe chucks.

Clamping pressure is absorbed by the clamping mechanism and is not transmited to the vise body.

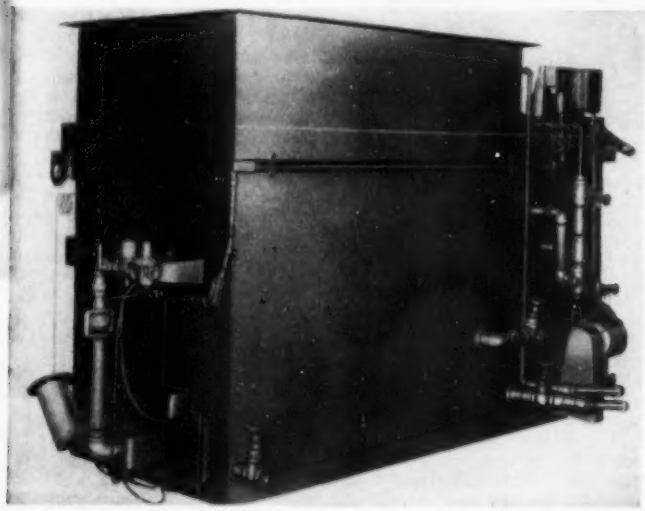
Precision Products Co., 76 Rogers St., Branford, Conn.

Gage Blocks Made Easy to Use By Micro-Step Gaging System

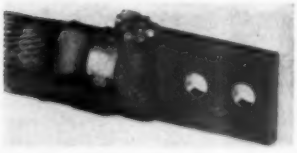
The nucleus of this system is a series of gage-block holders and end standards which are used to construct innumerable gaging and layout setups up to 72 in. long in steps of 0.000025 in. A precalibrated dial indicator is used with the holders and end standards for constructing precise indicating gages. The system makes it easy to use gage blocks in everyday operations.

Other components of the system include 5- and 10-in. sine plates and the "Height - Combination Tables — Heat Expansion Calculator" book which lists directly the gage blocks to be used in forming 10,000 different dimensions and which instantly gives the corrections to be made when checking non-steel parts with gage blocks, at temperatures above or below 68 F.

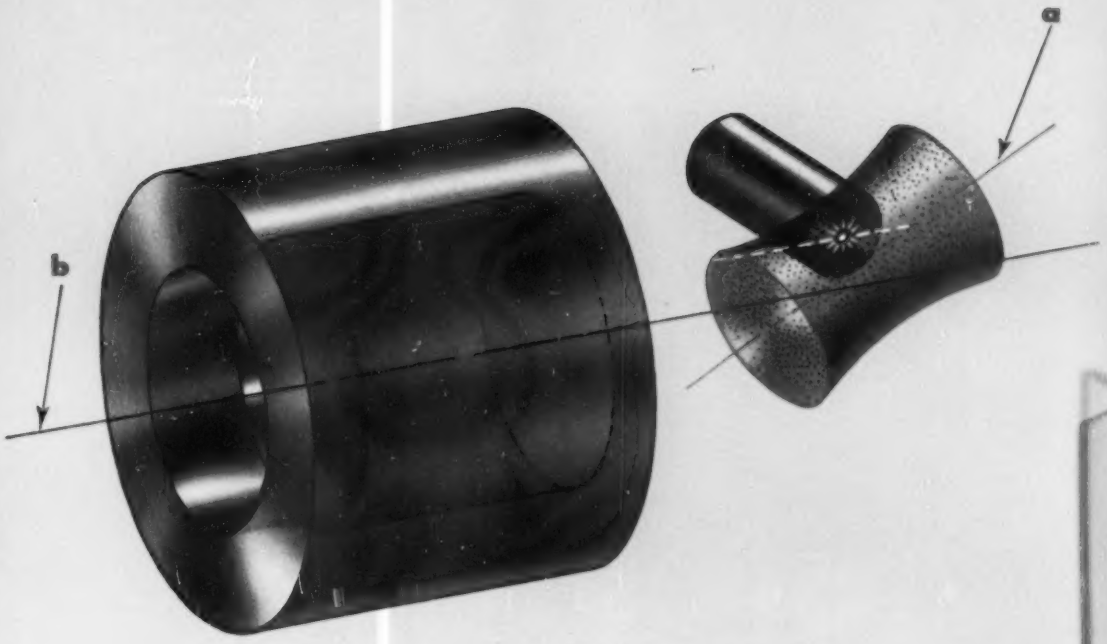
The DoAll Co, 254 N Laurel Ave, Des Plaines, Ill.



THE VS-800 DEGREASER (illustrated) has been redesigned with nine new features to provide greater economy of operation, greater utility, and easier maintenance. Also to display at the show will be the VS Junior, a semi-portable degreaser for cleaning small- and medium-sized parts. It is ideal for use in shops, laboratories, and plants where a high production rate is not necessary.—*Detrex Corp, PO Box 501, Detroit 32, Mich.*



THE CADWELD PROCESS is being used to weld large conductors. It is claimed to give consistent performance under extremely heavy currents, and to maintain 100% electric efficiency under adverse conditions such as heat and corrosive atmospheres. Illustrated is an electric-furnace lead to a ½x3-in. lug. Carrying capacity is 1750 MCM. —*Erico Products, Inc, 2070 E 61st Place, Cleveland 3, Ohio*



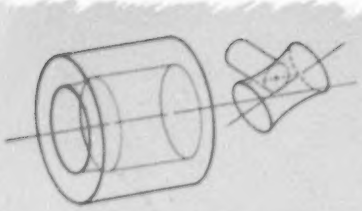
bryant
internal grinding

IT is generally believed in internal grinding that once the grinding wheel passes the diamond, the form of the wheel will be a perfect cylinder. In our illustration the wheel is tipped as it passes the diamond and an hourglass form is generated on the wheel. This condition is not peculiar to an internal grinder. The same form is generated in turning an O.D. on a lathe if the tailstock is either high or low.

The path of the diamond is a straight line across the surface of the wheel, but the wheel will not contact the work on the same straight line. Contact may be at a point on each end of the wheel. Since the wheel does not contact across its full face, wheel wear will be excessive and the wheel will act soft.

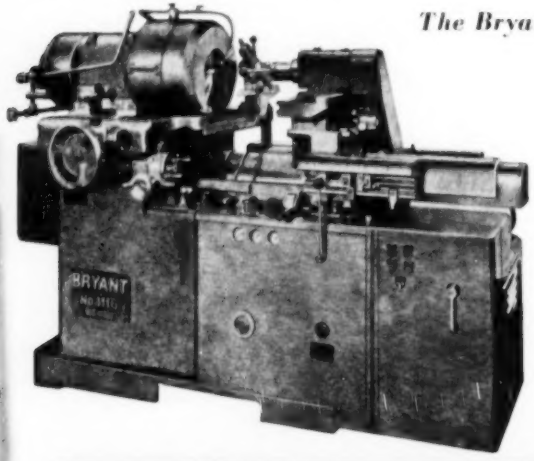
The geometry of the hole may be upset as in the illustration, with the result that the back of the hole will be tight. Neither turning the workhead nor changing the length of traverse will correct this error. Because the wheel is contacting at either one or two points, instead of a straight line, the surface finish will be poor. The remedy is to correct the alignment by bringing the wheel center line "a" parallel with the path of the wheel and in plane with the work center line "b".

Bryant Chucking Grinder Co. Springfield, Vermont



bryant
internal grinding

Accurate alignment of various machine elements is a basic consideration on even the simplest machine tool. Industry's demand for increased production and accuracy makes the alignment problem more critical than ever before. Bryant machines are designed so that they may be aligned, and this alignment may be maintained throughout the life of the grinder. Alignment and its effect on precision hole grinding is discussed on the preceding page.



The Bryant 1116 Hydraulic Hole Grinder

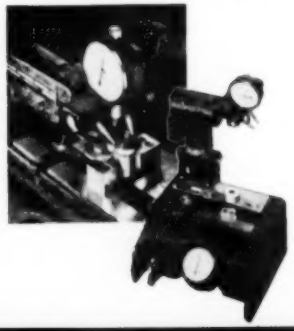
THIS is a precision toolroom and production hole grinder with all features and controls necessary for handling a variety of work with minimum time and effort. It has a swing of 16" with 8" maximum hole depth. The rigid 3-point wheel spindle support consists of a bar mounted in 2 cylindrical bearings with the rear of the slide supported on a hardened and ground guide plate. Tapers up to 90° included angle may be ground. A face grinding spindle may be used in addition to the hole grinding spindle. Write for full information.

Bryant Chucking Grinder Co., Springfield, Vermont, U. S. A.

bryant
thread gaging

Bryant gages are built on the principle of an "expanding" master plug for checking internal parts, or a "contracting" master ring for checking external threads. A dial indicator gives a reading of P.D. which includes variation in thread form and lead. This is an accurate indication of assembleability.

The Bryant Thread Gage with Squareness-of-Face Attachment



WHEN a face must be checked square with an internal thread, the part should be held on the thread flank and rotated in this position. The Bryant Gage does this, regardless of variation in roundness, P.D., lead or thread form. The squareness-of-face indicator is raised by a yoke at a constant rate regardless of face run-out, thus giving a direct and exact reading of squareness with the thread axis. Simultaneous readings can be made — the Bryant Gage checks thread size — the Attachment shows face run-out.

Yes—"2 in 1" filing at every stroke!

And only Heller Nucut gives it to you!

HELLER NUCUT WAVY TEETH FILE

Reg. U. S. Pat. Off. Pat. No. 2127139

WITH A NUCUT YOU FILE MORE, FASTER, BETTER WITH LESS EFFORT

Just take a few strokes... and you'll prove NUCUT's superior cutting power to your own satisfaction. NUCUT's *two* distinct sets of teeth, scientifically positioned in a patented wavy construction, make the difference.

The coarse teeth cut clean, deep, true—without scraping or skidding. At the same stroke, the fine teeth leave the surface sleek, smooth. There you have it—the fastest, easiest, best filing you've ever seen.

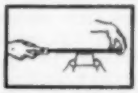
Your distributor has the sizes, shapes and cuts you need.

HELLER BROTHERS COMPANY
A New Jersey Corporation
America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO

Cash in on the file with the WHITE TANG

***Right way* to hold a file.** Hold handle with right hand and tip with left hand. Position of left hand varies with job.

(1) FOR GENERAL FILING: Let right thumb lie along the top of handle and fingers curl around handle in a natural grip.

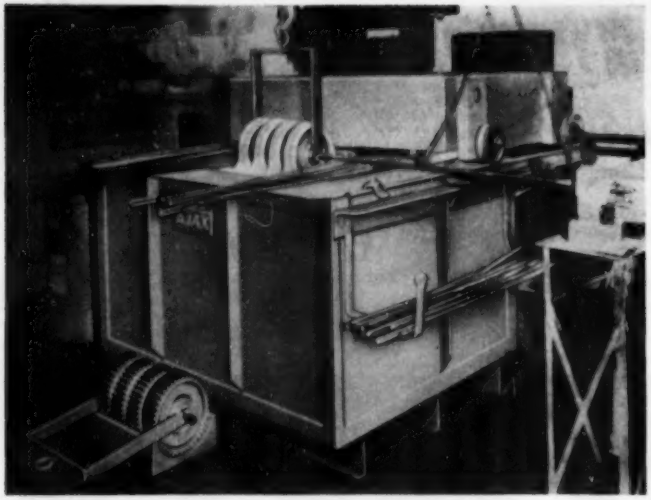


(2) FOR REMOVING STOCK RAPIDLY: Let ball of left thumb press upon top of file, and fingers wind around file.

(3) FOR FLAT FILING: Note extended position of thumb and fingers on top of file.

(4) FOR PRECISION WORK: The grip shown allows maximum guidance and control.

CONTACT YOUR INDUSTRIAL DISTRIBUTOR for our FULL LINE of American Pattern, Swiss Pattern, Milled Curved-Tooth and Rotary Files, Rasps, Machinists' and Carpenters' Hammers, Blacksmiths' and Farriers' Tools, Bricklayers' and Plasterers' Trowels, Craftmaster Scrapers, Chisels, Punches, Masterreaches and other quality tools.



Selective Heat Treating With Ajax Salt-Bath Furnace

A new application of the Ajax salt bath furnace allows the selective heat treatment of the rim or edges of circular edges, hardening teeth on gears or sprockets, and other products that require peripheral heating.

Either a neutral salt bath or a carburizing bath, heated by the internal electrode system, is maintained automatically at the specific temperature to which the work is to be heated. A number of the parts can be mounted on a shaft within a suitable fixture which is placed over the bath. Only that portion of the periphery to be heated is immersed. The work is then rotated and heating takes place very rapidly due to conduction by the intimate contact with the liquid salt. Many parts can often be heat-treated at one time.

Speed of heating approximates the rate at which the work conducts heat. The hot "carry-over" layer of salt clinging to heated portion supplements heating and assures uniformity. The surface of work heated is protected from the air throughout the entire operation due to the layer of liquid salt clinging to the revolving surface. Since no temperature head is employed, overheating of work is impossible. When not in use in this application, the salt bath is available for conventional heat treating.

Ajax Electric Co, Inc, Frankford & Delaware Aves, Philadelphia 23, Pa.

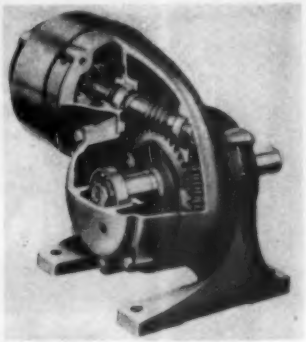
Miller AC Transformer Welder

The Miller Model 44 is an ac transformer welder which is reconnectable for use on 110-v ac, single-phase, 60-cycle power lines. It has a movable primary coil, ample open-circuit voltage, space-layer wound coils, and glass insulation.

It incorporates two ranges, the low range for electrodes up to ⅛ in. on 220 v, and the high for 5/32-in. electrodes on 220 v. Capacity is ⅛-in. electrodes when used on 110 v.

It is equipped with two wheels for easy portability, weighs 150 lb, and is 28 in. high, 14 in. wide, and 14 in. long.

Miller Electric Mfg Co, Appleton, Wis.



Pyramidal Base Provides Strength On Right-Angle Gearmotor

The type GW Syncrogear provides a centilever design to protect gear alignment. A one-piece pyramidal base provides maximum structural strength in the area of greatest load, surrounding and supporting the take-off shaft bearing. "Spread-eagle" feet stabilize the pyramidal base and the entire assembly. The gear and motor housings are free from distortion.

Splash lubrication, ball-bearing construction, hardened and ground worm, leakproof oil seal, and asbestos-protected windings are some of the other features of this unit. Produced in a speed range from 20 to 155 rpm with gear ratios up to 58:1, the Type GW is offered in 3-phase from 1/3 to 3 hp and in single phase from ¾ to 1 hp. The gearmotors may be installed vertically or horizontally. Footless flange mounting is optional. Models include variable-speed, splashproof, or totally enclosed.

U S Electrical Motors Inc, Box 2058, Terminal Annex, Los Angeles 54, Calif.

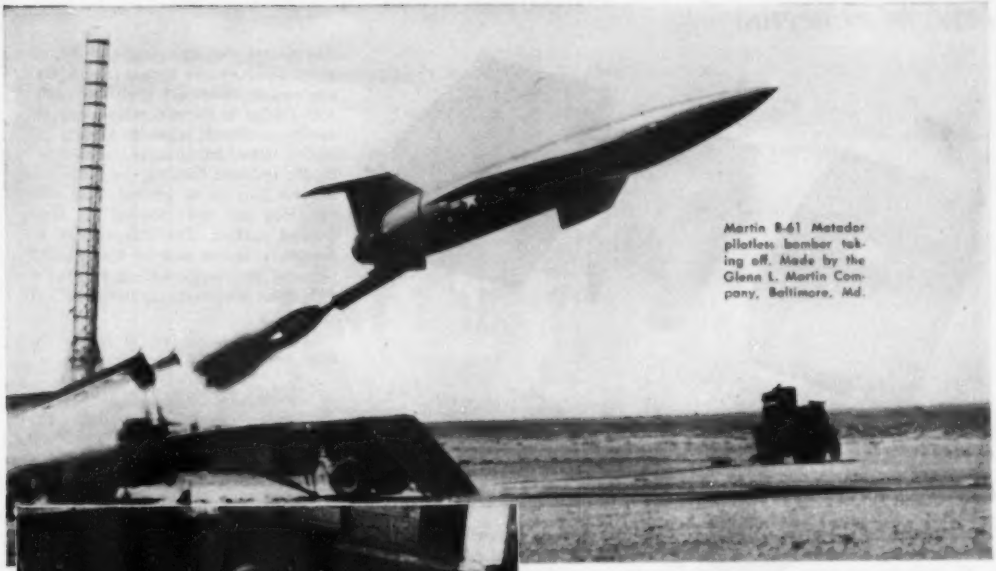
Double Cam Lock on Brass Welding-Cable Connector

The design consists of a double cam principle where one cam exerts pressure parallel to the axis of the connector, and the other perpendicular to the axis. Contact approaching the 600 psi needed for minimum resistance is obtained.

General purpose Cam-Lok connectors (for 1/0 through 3/0 cable and No. 2 through 1/0 whip ends) are completely interchangeable with heavy-duty connectors and heavy-duty female terminal connectors. Long runs of cable can be graduated from 4/0 down to a light whip end for maximum flexibility and minimum voltage drop. No adaptors or reducers are needed.

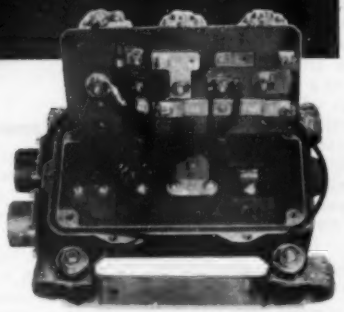
The connector is self-compensating for wear, has no spring action, and reduces arcing and burning because of the high-pressure contact.

Cam-Lok Div, Empire Products, Inc, P O Box 98-D-1, Cincinnati, Ohio



Martin B-61 Matador pilotless bomber taking off. Made by the Glenn L. Martin Company, Baltimore, Md.

Jeep almost completely submerged. Can be operated in this position at about 9 miles per hour. Made by Willys-Overland Motors, Inc., Toledo, Ohio, for the Armed Forces.



Generator regulator for the 24-volt system of the submersible Jeep. This is completely waterproof and highly resistant to corrosion and fungi. Produced by The Electric Auto-Lite Company, Toledo, Ohio.

Illustrated are two of the many types of capacitors and filters made by Aerovox Corporation, New Bedford, Mass.; an important capacitor supplier to both Electric Auto-Lite and Glenn L. Martin. The unit above is the filter capacitor used in the generator regulator of the submersible jeep while the unit at the right is used in the pilotless bomber.

In the Air— On Land— Under Water—

WHERE REQUIREMENTS ARE SEVERE, CALL REVERE

The dramatic pictures on this page show two important special applications of Aerovox capacitors. One is the Martin B-61 Matador pilotless bomber. It contains an Aerovox capacitor, which has to withstand the terrific acceleration and speed of the craft. The other is the submersible Jeep. Its 24-volt electrical system is completely waterproofed, and includes Aerovox filters and capacitors for suppression of radio interference. Revere not only supplied copper and brass strip for the capacitor cases, but collaborated closely in setting up specifications, and in addition worked on a welding problem. In regard to the latter, an Aerovox Project Engineer wrote: "We have had much better welds." . . . Revere is always glad to collaborate on problems concerning copper and its alloys, aluminum alloys, and electric welded steel tube. Call the nearest Revere Sales Office.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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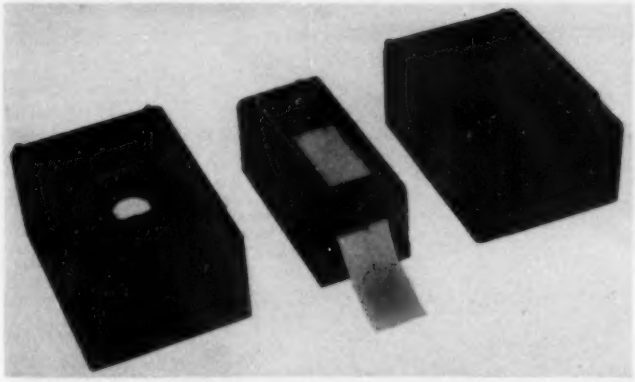


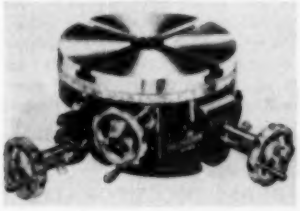
Analyzer Records Variables in Operation of Resistance Welder

The Model BL-213 welding analyzer records the special variables present in the operation of three-phase resistance welding machines. It is also capable of measurements on single-phase resistance spot, projection, and seam-welding machines. It records the magnitude and timing of welding variables, consistency of operation, and calibrates the equipment.

The analyzer consists of a universal amplifier, a modified dc amplifier, and a special dual-channel direct-writing oscillograph. The universal amplifier and one channel of the recorder, along with an appropriately mounted resistance-sensitive pickup such as an SR-4 strain gage, record electrode-pressure variations showing contact-gage setting, precompression force, weld force, rate of rise, forge force, and time of operation in milliseconds. The modified dc amplifer and a specially designed penmotor used on the other channel of the dual-channel oscillograph record either the primary or secondary (weld) current, showing the time duration of the weld current. Information on the procurement of fabrication of necessary special pickups for a wide variety of welding machines has been included in the operating instructions.

The universal amplifier controls permit balancing the strain-gage network and centering the oscillograph pen trace. An 8-position attenuator provides the amplifier—oscillograph combination greater flexibility over wide electrode-pressure variations. In addition, the amplifier has an internal calibration circuit which is easily adaptable to a wide range of pickups. The high writing speed of the amplifier-oscillograph combination is designed to record sudden variations of electrode pressure. The low-gain dc amplifier section may also be used separately, providing a second channel for voltage or current recording.

The Brush Development Co, 3405 Perkins Ave, Cleveland 14, Ohio



Dual Cross-Feed Rotary Table

Palmgren No. 83 has a circular table 8 in. in dia with a ⅝x¼x1-in. T-slot. Unit is precisely graduated for the full 360° by single degrees in right-angle segments; adjusting screw permits accurate setting to any position.

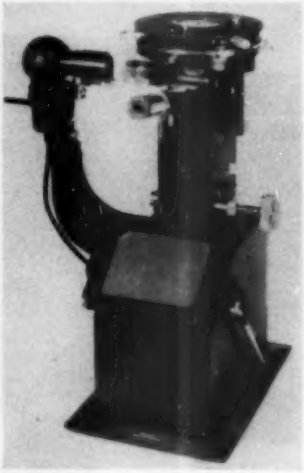
4-in. cross-feed movement, which provides a 2-in. travel each way from center, is controlled by another graduated screw to permit infinite adjustment within travel range.

Base has four convenient bolt and key slots for rigid mounting of the table to a milling machine, drillpress, shaper, or surface grinder.

Chicago Tool & Engrg Co, 8383 S Chicago Ave, Chicago 17, Ill.

Aluminum etching compound No. 60 gives a velvet-like appearance to the surface. It does not scale—a light, soft sludge is formed which can be easily removed with a stream of water. Other advantages claimed include: reduced fuming, long-life solutions (up to 4 weeks), and the solutions are not clouded by suspended matter. The composition is a white granular powder that should be used in concentrations of 2 to 6 oz/gal, at temperatures between 140 and 180 F.

Oakite Products, Inc, 19 Rector St, New York 6, NY



Single-Unit Camera Microscope

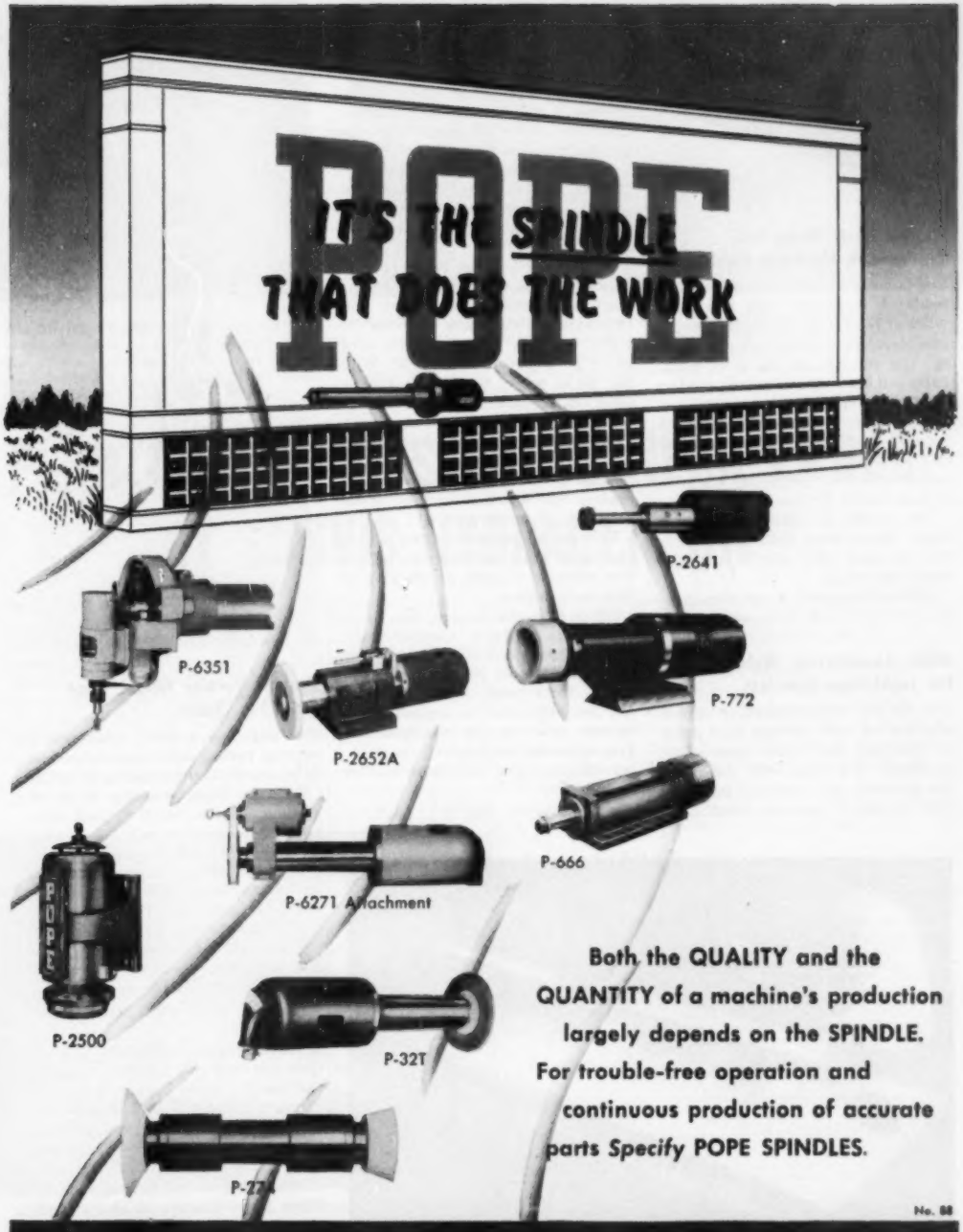
Reichert Universal ME&F metallographic unit combines camera and microscope in one instrument. Changeover from microscopy to photo-micrography is carried out by a single manipulation. Picture size of the camera is 3 ½x4 ¾ in., which eliminates necessity for enlarging. Magnification can be continually changed, and range is from 4.5 to 2200.

Ordinary and polarized illuminations are reflected and transmitted. The dark ground effect causes smallest cracks, pores, and scratches to shine brightly.

When placed on stage, specimen is automatically aligned perpendicularly to optical axis. Direct observation is available through eyepiece tube or on ground-glass screen.

Accessories include a micro hardness tester that measures the indentation in one reading.

William J Hacker & Co, Inc, 82 Beaver St, New York 5, NY



Both the QUALITY and the QUANTITY of a machine's production largely depends on the SPINDLE. For trouble-free operation and continuous production of accurate parts *Specify* POPE SPINDLES.

No. 88

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION

Welders Task Made Easy By Cam-Lok Electrode Holder

The loading trigger on this electrode holder is operated with one hand without fumbling. The trigger works easily, yet jaws grip electrodes firmly. The position of the jaws eliminates rod bending and makes welding in cramped spaces easier.

The holder is insulated with tough laminated material. There are no coil springs in the operating mechanism which is completely enclosed and protected by the insulation.

The holder is available in three sizes: Heavy-duty (500 amp); general purpose (300 amp); and light duty (200 amp).

Cam-Lok Division, Empire Products Inc, P.O. Box 98-D, Cincinnati, Ohio

Miller Low-Current Welder For Light-Gage Stainless

The SR-100 welder employs unusually low currents on very light gages of stainless steel and other alloy products. It is used with the inert-gas-shielded arc process, but may also be used for normal metallic arc welding. It is a selenium rectifier DC welder having a range from 8 to 135 amp. This range is available through a low tap having an operating range of 8 to 65 amp and a high tap having a range of 35 to 135 amp.

Machine is designed to operate on 220/440, 3-phase, 60-cycle current and can be supplied for 208/220/440 or 220/440/450 primary windings as well.

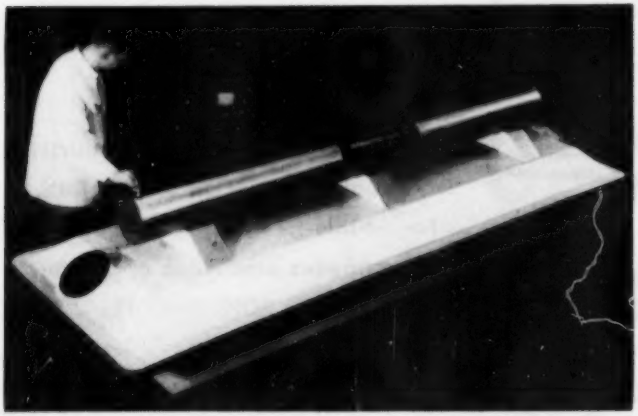
Standard SR-31, SR-32, and SR-33 panels used in conjunction with the inert gas shielded arc process and incorporating automatic controls for water and gas valves can be used as an accessory on this unit. With the SR-33 panel, the welder can be used on Heliarc spot welding applications.

Remote control of the welder can be accomplished either through a manually operated or foot operated control box which is applied as an accessory at extra cost.

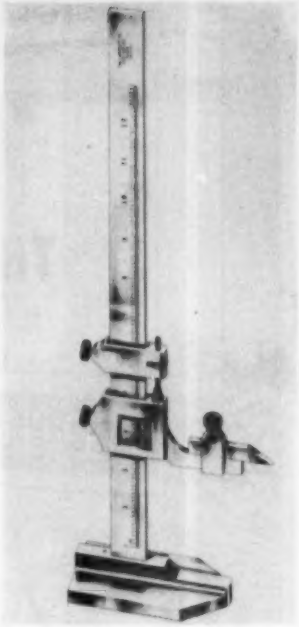
Primary amperage at rated load is 24 amp at 220 c and 12 amp at 40 v. The machine is rated at 100 amp at 60% duty cycle.

Other than the cooling fan, there are no moving parts. Control is accomplished electrically through the use of a variable rheostat mounted on the front panel of the machine. Arc flexibility due to instantaneous voltage recovery and minimum arc flow apparent in standard dc welders feature the selenium-rectifier dc welder.

Miller Electric Mfg Co, Appleton, Wis.



SEGREGATION-FREE TOOL STEEL—Bar of M-2 molybdenum high-speed steel weighing a ton and a half is checked with Ultrasonic Reflectoscope to prove its soundness. Latrobe can now produce Desegetized steels (free of carbide segregation) in much larger sizes than former limit of 500 lb. High-carbon, high-chromium and high-speed steels are available in 12-in. sections. — *Latrobe Steel Co, Latrobe, Pa*



Starrett Vernier Height Gage Has 13-in. Scale

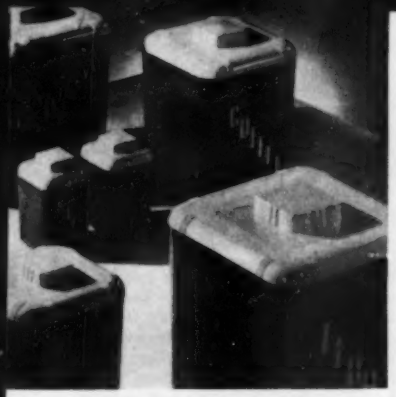
This gage has a 13-in. scale which permits taking readings over a full 12-in. range in thousandths of an in. (A vernier gage with only 12 in. of graduated scale cannot be read with accuracy beyond 11 in.)

The bottom of the base and scriber are hardened and lapped and the bar is hardened with machine-divided graduations. The scriber is easily removable for sharpening or for substituting attachments or a dial indicator. The vernier plate is adjustable to maintain the zero point.

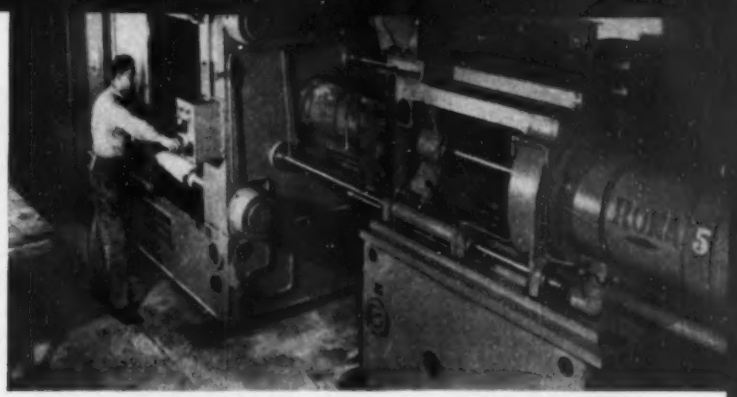
The L S Starrett Co, Athol, Mass.

A chrome-nickel austenitic stainless steel has been developed that work-hardens far more slowly than conventional grades of stainless. Its use makes possible commercial production of chrome-nickel fastenings and other parts requiring similar drastic cold heading or upsetting operations. Other developments: sulphuric-acid-resistant steel available in rolled forms; non-deforming die steel combining low-temp heat-treating with uniform, deep hardenability; application of a rare-earth element to the production of high-alloy steels to make them hot workable.

Carpenter Steel Co, Reading, Pa.



NO MORE PROBLEMS. The production of plastic household items by Rona Plastic Corporation was slowed down by an inadequate hydraulic oil. A switch to Sunvis 999, over a year ago, restored it to normal.



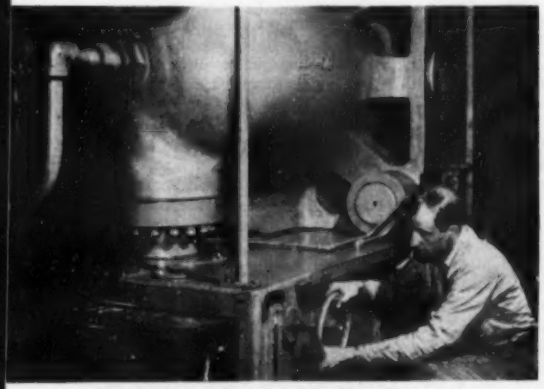
PRESSURE LOSSES ENDED. There are few plastic molding machines as big as this 60 ounce model. It exerts a pressure of 1,000 tons. Because the hydraulic oil formerly used sludged up and thinned out, it could not maintain this pressure. But Sunvis 999 has fully met these severe requirements, as well as those of Rona's nine other hydraulic machines of varying sizes.

PLASTIC MOLDER'S BOTTLENECK ENDED BY SUNVIS HYDRAULIC OIL

More than a year ago Rona Plastic Corporation, New York City, had trouble with its hydraulic molding machines. The machines functioned erratically due to oil sludge sticking the control mechanisms. In addition, the oil thinned out excessively at normal operating temperatures, and resulted in the loss of proper clamping pressures on the dies. To keep the machines going at all, it was necessary to drain, clean, and entirely recharge the systems at frequent intervals.

A Sun representative, called in by Rona, studied the problem and recommended Sunvis 999. He knew it would put an end to pressure losses, because, even at elevated temperatures, it does not decrease in viscosity as much as most other oils. He also knew its exceptional stability would end the sludging problem.

Sunvis 999 proved to be the answer to all Rona's hydraulic oil problems. The original charges, with minimum make-up, are still giving good service. Rona can expect the same performance for a long time to come, because experience shows that under normal operating conditions, Sunvis 900 Series Oils are *good for the life of the equipment.*



NO OIL CHANGES HAVE BEEN NEEDED. Before Sunvis 999 was adopted, the oil in each of the machines had to be changed frequently (the one pictured holds 450 gallons). The original charges of Sunvis 999 have been in use now for more than a year.

Department AM-10
Sun Oil Company, Philadelphia 3, Pa.

I am interested in knowing more about Sun Hydraulic Oils. ☐ I would like to consult with a Sun representative. ☐ Send the booklet "Hydraulic Fundamentals and Industrial Hydraulic Oils."

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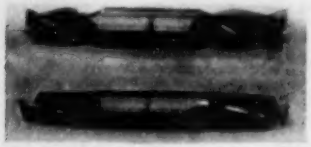


Microtrue End Mills

These mills have a unique rake design and are built of 12.5% tungsten steel to provide smooth cutting and maximum service. They are said to reduce load and distortion, yield cleaner corners, straighter sides, and smoother bottoms. Imported from Germany by:

Precision Products Co, 76 Rogers St, Branford, Conn.

Adjustable Safety Clutch on Direct-Drive Tapper

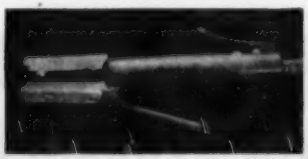
The Microtrue is a direct-drive tapper equipped with an adjustable safety clutch. Tapping speed is spindle speed; on lifting spindle lever, tap reverses at double speed. No pressure is required to drive the tap which is floated in to produce good threads.

Moving parts are hardened and precision ground and all parts are interchangeable. Imported from Germany by:

Precision Products Co, 76 Rogers St, Branford, Conn.

Paint stripper R-6 is a gray, dustless granular material that is completely soluble in water. Solutions of R-6 are highly alkaline in nature. For removing oil-base paints, certain types of lacquers, synthetic finishes, grease, and caked-on oil a concentration of 6 to 16 oz/gal. is recommended at temperatures from 180 to 210 F. Work is immersed long enough to effect complete romoval and the operation then completed by a cold-water rinse. Solutions are free-rinsing so that clean, streak-free surfaces are obtained. It is designed for use on iron, steel, copper, and magnesium but is not recommended for aluminum, brass, tin, or zinc.

Oakite Products, Inc, 19 Rector St, New York 6, NY



Torch Gouges, Cuts All Metals By Carbon Arc and Compressed Air

Arcair torch, a process of gouging and cutting all metals, uses only carbon arc and compressed air. In addition to its low operating cost, the product has a variety of applications: for fabricators, removing welds, cleaning roots of welds and grooving plate; for foundries, removing casting defects.

The torch operates on dc welding current, features air-control valve, adjustable electrode angle, self-aligning jet, and concentric cable. Price complete is $87.50.

Arcair Co, 3614 Burwell St, Bremerton, Wash.

Composite metal combinations recently developed include: titanium-clad steel, zirconium-clad nickel, calcium-clad nickel, platinum-clad stainless; copper-clad magnesium, and nickel-clad copper. Recent progress in bonding techniques make it possible to bond practically any combination of malleable metals in various thickness ratios.

General Plate Div, Metals & Controls Corp, Attleboro, Mass.

No. 140 Stik-Wax is a stick lubricant for metal sanding, metal sawing, pipe cutting and threading, drilling, tapping, grinding and flush riveting. 1-lb, 2-in. dia product can be applied manually or automatically. Wax lubrication provides better finish on worked pieces; burrs are eliminated when metal is cut or drilled, and smoother finish is achieved when grinding or sanding metal surfaces. Price of lubricant is $1 per stick in case lots of 24.

S C Johnson & Son, Inc, Racine, Wis.

Reverse-current conditioner for zinc die castings removes the surface films, disturbed metal, and last traces of soil prior to plating. It also avoids the hydrogen-gas formations that raise blisters when castings are heated after electroplating. There is claimed to be no blackening during anode cleaning—castings do not lose their brightness.

Oakite Products, Inc, 19, Rector St, New York 6, NY

Clip Splicing Method Simplifies Wire Patenting

Model R-120-187E Guillotine Splicer unit and splicer clips to connect wire ends of coils for drawing through patenting furnaces have the following features:

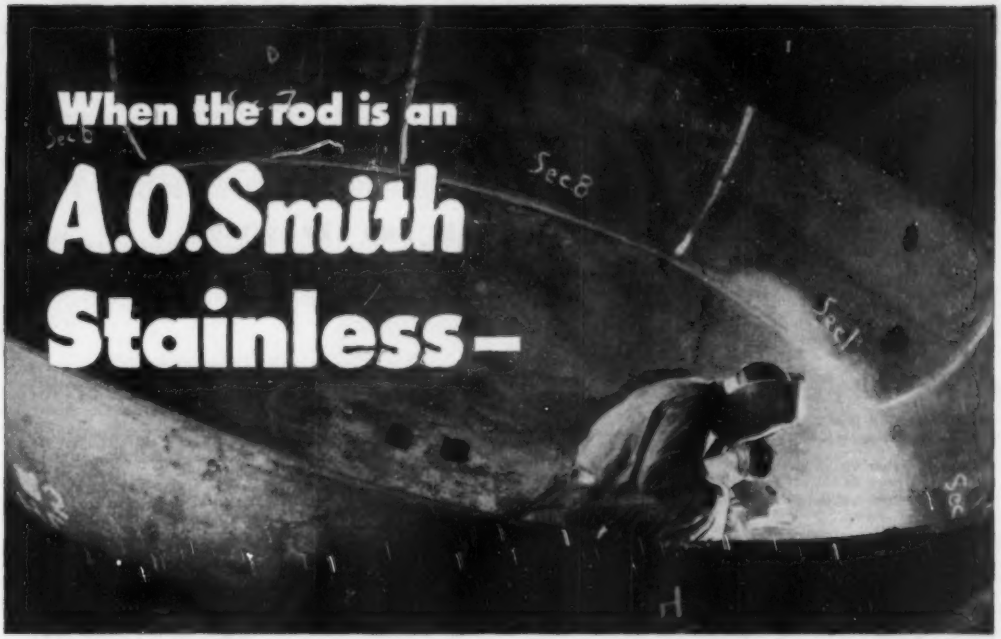
Elimination of heating, manual bending, tied ends; precludes need for welding equipment: heat number of coil can be stamped on clip, providing positive quality control; equipment can be used in late-design tube furnaces.

Wire end is slipped into clip, which is inserted into splicer; unit is activated by thumb-button valve control, locking wire to clip. Connecting operation is completed by repeating procedure with other wire end; clips are cut off after patenting operation.

Unit has an available thrust of 10 tons; operating cycle is one second; power source is a 2-hp, 220/440-v, 3-phase, 60-cycle motor driving hydraulic pump. Clips are available in two sizes: No. 1, 7/32-in. max wire capacity; No. 2, ½ in.

Pump comes complete with 25 ft of hydraulic hose. Spring-tension unit is available for splicer, if desired, at additional cost.

Manco Mfg Co, Bradley, Ill.



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BECAUSE of A. O. Smith's matchless quality control

You, too, can eliminate field failure due to weld corrosion, with A. O. Smith stainless electrodes . . . your "insurance policy" that *your* specified requirements are met *exactly*.

"Tramp" steel cannot enter for manufacture because our quality control prevents it. No incoming coil of stainless core wire is *ever* acceptable for processing until exacting chemical, metallurgical and *spectrographic* analyses *prove* that it matches our specifications from end to end. This assures you of receiving the exact type and analysis of stainless to meet your job specification.

For your protection here are some of *our* controls: No more than one splice is permitted in any incoming coil. Why? So that, when we clip samples from each end of each coil for analysis, no part of any coil can escape the test. Then, when approved coils are straightened and cut, the wire is immediately sealed in boxes to prevent mixing of lots.

As one of the largest users of stainless electrodes in building stainless vessels, A. O. Smith knows that these tests and precautions are necessary to assure top-quality production. No other electrode producer subjects stainless core wire to the exacting spectro-analysis, chemical and metallurgical tests as is done by A. O. Smith.

When you buy A. O. Smith stainless electrodes, you receive this matchless assurance of highest quality without paying any premium! A compelling reason for *insisting* on A. O. Smith stainless every time!

We'll welcome the opportunity to demonstrate A. O. Smith stainless electrodes on your job.

Write for free pocket-size electrode handbook.

A. O. Smith Certified Stainless Electrodes

ALL-POSITION

Electrode	AISI Type
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SW-152	505
SW-153	410
SW-154	430
SW-157	347
SW-158	317+Cb
	318
SW-159	310
SW-160	316
SW-161	317
SW-162	308
SW-166	309
SW-168	310+Mo
SW-169	310+Cb
SW-357	347
SW-359	310
SW-362	308

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You Can Hold Tolerance and Obtain Desired Surface Finish in a Single Honing Operation

SUNNEN HONING MACHINES
"Accuracy at Low Cost"

Frequently production can be stepped up, as on this cast bronze main bearing for outboard motors, by using a single honing operation to obtain the required size and surface finish.

Problem: To hold a tolerance of +.0003", −.0000" and produce a surface finish of 10-18 micro-inches, at a satisfactory production rate.

MATERIAL: Cast Bronze
HOLE DIAMETER: 1.005"
HOLE LENGTH: 1 5/16"
STOCK REMOVAL: .0007"
PREVIOUS OPERATION: Boring

Hole is interrupted by an oil groove.

Solution: Sunnen Model MBB-1290 Honing Machine, with "K" type Honing Unit. Machine was installed and in operation in less than 45 days after original inquiry.

Results: Motors run smoother, quieter — bearings last longer — rejects cut to practically nothing. Production rate stepped up to *one part every minute.*

Sunnen Honing is showing similar results on hundreds of different parts in leading plants across the country. It is accurate, easy to use, fast — often does the job when nothing else will. On short runs you can frequently complete the job in less time than it would take to set up for other methods. Average installation costs less than $1,000.

HERE'S WHAT THESE VERSATILE MACHINES CAN DO FOR YOU

- Generate geometrically round and straight holes.
- Eliminate grinding in many cases — remove up to .006" and more from hardened steel.
- Produce bearing finishes to 2 RMS in hardened steel.
- Correct out-of-roundness and warpage.
- Eliminate bellmouth and taper in holes.
- Remove burrs and flash from holes.
- Correct heat treat and assembly distortion.
- Hold accuracy to .0001" and better.
- Salvage expensive rejects from other operations.
- Eliminate jigs and fixtures — most jobs can be set up in less than a minute.
- Produce accurate blind holes.
- Size and finish holes with ports, lands, keyways.
- Hone metals, glass, plastics, ceramics.
- Hone diameters from 1/8" to 2 1/2".

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shows you many different ways Sunnen Honing is helping others — suggests ways it might be helpful in *your* plant.

Let SUNNEN HONING Solve Your Hole Problems

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Canadian Plant: Chatham, Ontario

693

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☐ Have a Sunnen Honing Engineer call.

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Company .....
Address .....
City ..... Zone ..... State .....

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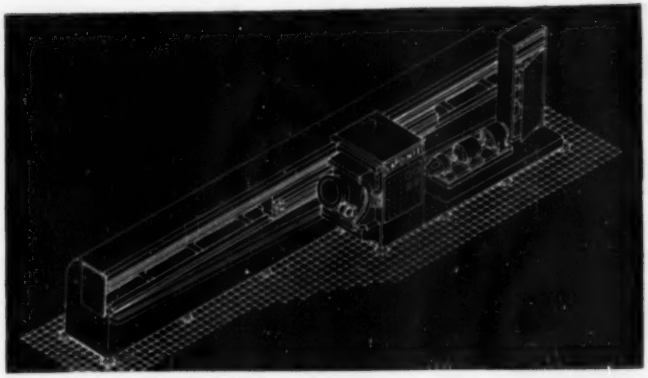
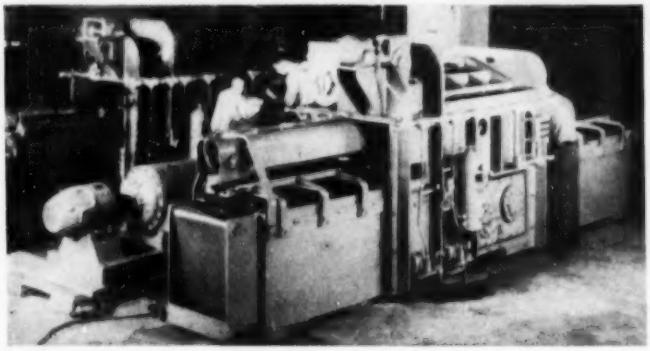


Fixture for automatic indexing of turbine wheels, with its own drive, is at left of main housing on this 150-in. stroke horizontal broach which will operate at over 150 fpm. The 200-hp dc electric drive is between housing and electrical panel



Two 90-in. broaches tooled up for cylinder heads at 150 fpm. These are forerunners of the forthcoming larger unit

Horizontal Broach Operates At 150 fpm and has 200 hp

Improvements in broaching machines forecast by needs of jet-engine and aircraft producers (AM Aug 11 '49, p 98) are beginning to appear. Latest is a horizontal broach developed originally to cut anchor slots in jet compressor rotor disks and turbine wheels at speeds below 50 fpm, but now redesigned to provide speeds above 150 fpm, with drives up to 200 hp. The frame is heavy and rigid to handle high-power, high-speed broaching, and strokes can be provided from 66 to 200 in.

The machine, designed by the LaPointe Machine Tool Company, Hudson, Mass., and soon to be announced, is quite like a planer turned on its side, and has a similar drive. A dc motor with its own power unit

(Continued on page 214)

Trends in machine tools, as well as other metalworking equipment, materials, and components are summarized in the forthcoming 75th Anniversary Issue of **American Machinist.** Watch for your copy—and study the 10-year forecast as a background for your own forward planning. This issue will be mailed to subscribers in the middle of November.

... INCLUDING

Vertical milling machine has a table-movement accuracy of 0.004 in. page 214

Injection-molding machine plasticizes the powder before it contacts the injection plunger page 216

Double-action toggle press is arranged for twin drive and is equipped with a drum friction clutch page 216

Organic bond used to join metals requires little heat, no pressure or fluxes page 218

Resistance spotwelder features a quick-adjusting device for controlling pressure and electrode travel .....page 218

Balancing machine measures vibrations and discovers source by stroboscope page 220

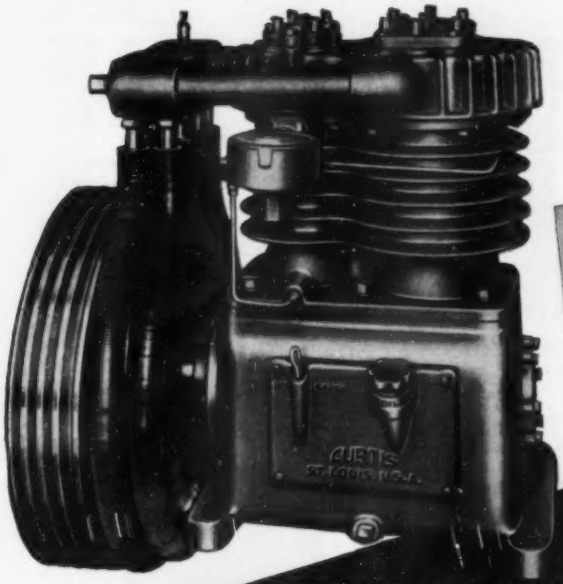
Toolholder features vertical adjustment of toolbits without moving in holder .....page 222

Auptomatic polishing head for deburring turbine-disk slots can be adjusted in any angular position page 224

... and in Oct. 27

Lapping machine is equipped with a 60-in.-dia segmental bonded disk

Universal girth welder has a tilting table with variable rotative speeds



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Two Stage Air Cooled 15 and 20 Horse Power

designed to give you **even greater dependability**
lower cost operation
longer life

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drives a bull gear through a reducer. The bull gear drives a herringbone rack on the main slide, which, like other sliding members subject to scoring, is lined with natural phenolic plates sliding on heat-treated Meehanite ways. Thus the main slide is mechanically actuated, although hydraulic units in the machine base operate clamping fixtures of whatever type may be required, particularly indexing and tilt types.

Dual speed is provided through the control panel, so part of the stroke can be at one speed, the remainder at another. Thus roughing can be done at 50 fpm, finishing at 30 in the same stroke, speed being changed automatically by a limit switch on the slide. Both speeds are simply set on dials on the panel. Where continuous broaching would result in excessive distortion, the control can be set to rough all anchor slots in a rotor disk, for example, using only the roughing section of the broach, then to go on automatically to index for the finishing cuts, using only the finishing section of the broach.

Thus high surface speeds, heavier powers, long stroke, and change of speed are all incorporated in one machine.

The Lapointe Machine Tool Co, Hudson, Mass.

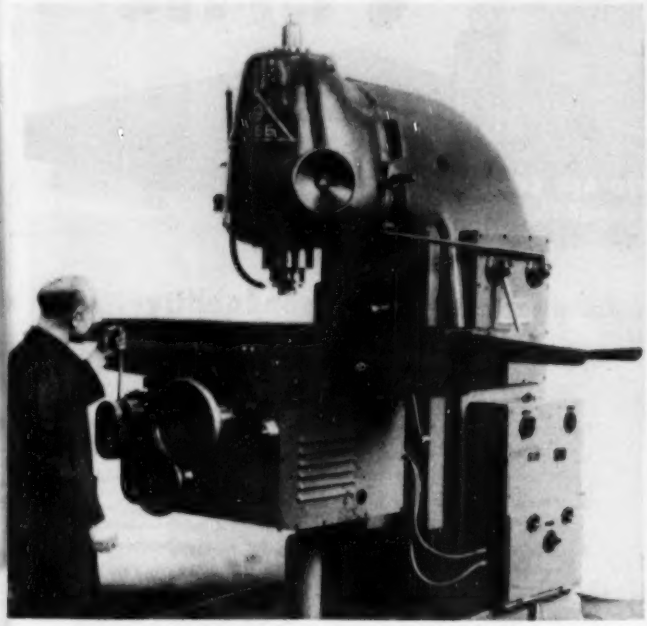


Table Moves to Within 0.0004 in. On Nube Vertical Milling Machine

Specifications for Largest Model	
Table working surface	80x20 in.
Power feed range, longitudinal	67 in.
Cross	18⅞ in.
Vertical	17¾ in.
Gap	21½ in.
Spindle motor	25 hp.

Table sizes up to 80 x 20 in., table-movement accuracy within 0.0004 in. and single-lever control are among the advantages offered by this German-made vertical miller.

The machines are extra rugged to permit the heaviest cuts. Heavily bribed knee design, saddle bedways the same length as those of table, result in accurate, vibrationless performance.

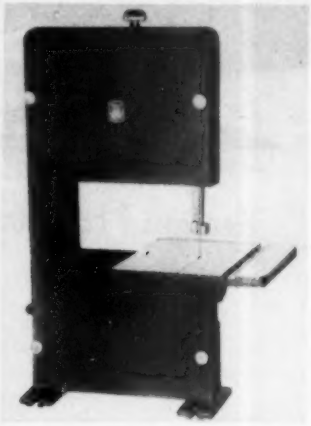
They can be adapted to automatic cycling by means of easily accessible trip dogs mounted on the front of the table. Accurate control of table movements to and from power, feed, rapid traverse, and stop eliminate hand adjustments when the machine is used on automatic.

The vertical spindle head can be swiveled 45° in either direction and horizontal spindle can be used with an overarm for greater rigidity. Both spindles have axial adjustment, permitting simultaneous vertical and horizontal milling. Bellows protect the ways from chips.

After direction of movement of the longitudinal, transverse or vertical table traverse has been preselected by switch, a single control lever starts milling spindle and starts and engages power feed and rapid traverse.

The speed can be changed at any time. Speeds are engaged by magnetic clutches, and there is no idle time when shifting. Twelve spindle speeds and 24 feeds are provided. Controls for spindle speeds are within easy reach of the operator.

Kurt Orban Co, Inc, 205 East 42nd St, New York 17, NY



Small Metal-Cutting Band Saw

This saw is claimed to do everything that saws in the $600 price field will do within the limits of its 5⅜-in. throat capacity. It is intended as an auxiliary unit to the large metal cutting machine, so often kept tied up with big work.

A large work table smoothly tilts to 45° and is grooved to take a mitre gage for angle or compound cuts. Known as the Tomlee, it is of heavy cast-iron construction, has ball bearings throughout, operates four speeds, and is powered by a ½-hp motor furnished as an extra. Included with the saw are a set of guides, a ⅜-in. blade, and instruction bulletin. Accessories available are an all-steel cabinet stand, mitre gage, and a rip fence. The saw is priced at $89.50.

Tomlee Tool and Engineering Co, 718 Washington Ave, North Minneapolis 1, Minn

Delpark

Studebaker

Cleaner, trouble-free grinding operations, speed production, save money at the Studebaker Corporation Plant in South Bend, Indiana.

Delpark Filters insure clean coolant in grinding operations . . . permit freer cutting wheels, lengthen coolant life, and eliminate downtime of grinders for cleaning of reservoirs. By supplying clean coolant, machine efficiency is increased, less wheel dressing is required, wheel life is lengthened and greater grinding accuracy is achieved.

Removal of hot particles lowers coolant temperature, retards deterioration. Coolant remains clean, delays coolant becoming rancid.

This Delpark Filter serves as a central system for four centerless grinders. The coolant flow is 120 gallons per minute.

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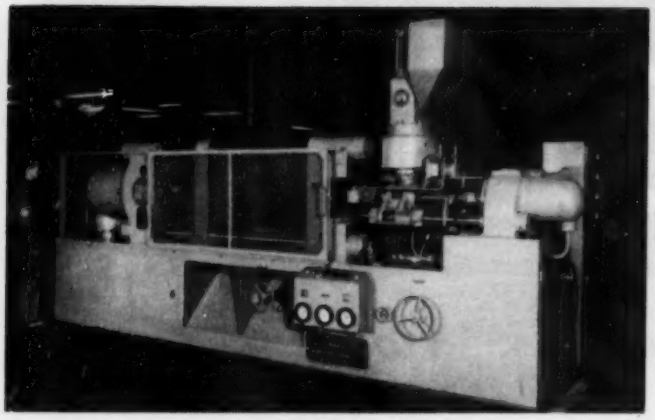


Injection-Molding Machine Produces 14-in.-Deep Parts

Model 400-P-48 is an injection molding machine which plasticizes the molding powder before it contacts the injection plunger. It has a 48-oz shot capacity, high injection speed, a mold clamp capacity of 400-tons, daylight opening of 54 in., 30-in. mold-clamping stroke, and large mold-mounting space.

Unit produces parts up to 14 in. in depth; installation of the ram spacer makes it well suited for shallow parts.

Molders using the pre-plasticizer report faster rates, lower injection and clamping pressures, relatively strain free parts, less part distortion, and lower mold temps.

Hydraulic Press Mfg Co, Mount Ohio

Variable-Speed Transmission Has Built-In Brake Motor

A built-in brake motor for use with Graham transmissions provides for immediate stops required in indexing and positioning work. Applications include metering and proportioning work, and jobs where speed of one part of a materials-handling system must be synchronized with another part.

The transmission, in sizes from ⅛ to 3 hp, is available with or without built-in reduction of worm or helical spur types. A wide range of controls, including micrometer, lever, and remote electrical, may be had. Complete assembly of transmission, built-in motor with or without brake, built-in reducer, and control, mounts with only four bolts, and is considerably more compact than if each element were to be mounted separately. Built-in overload protection prevents damage in case of a jam in the driven equipment.

Brake is a direct-acting disk model, with no solenoid or mechanical linkages; motor and brake are connected in parallel. Model shown is available with or without motor.

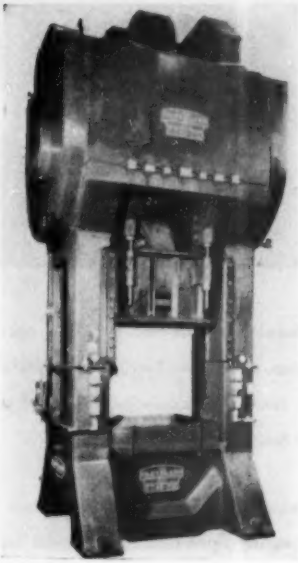
Graham Transmissions, Inc., 3754 N Holton St, Milwaukee, Wis.

Cutting Face at Any Angle On Diamond-Grit Dressing Tool

Diamond-grit tool is available in models for thread-grinding machines that grind V or straight-line threads either for production or gage work. The cutting element of the tool is a concentrate of selected diamond grits and alloy matrix. A cutting face is presented in any position, and only occasional turning is needed for effective dressing work.

Dressing is accomplished in the same time as with a conventional single-point diamond tool, but it is claimed the wheel does not break down as quickly and more pieces are produced between dressings. The wear ratio of the matrix is such that grits are always exposed and there are always sharp points until the tool is worn out. Because of the number of grits in contact with the wheel, a lighter dressing may generally be used.

Wheel Trueing Tool Co., Detroit, Mich.



Double-Action Toggle Press

This Cleveland single-crank, double-action toggle press is arranged for twin drive and equipped with a drum friction clutch with spring-loaded brake. The press, which has an air-counterbalanced slide, is provided with an auxiliary air brake on the flywheel to bring it to a quick stop when the press is being shut down, and the outer, or blankholder slide, has air-loaded safety links.

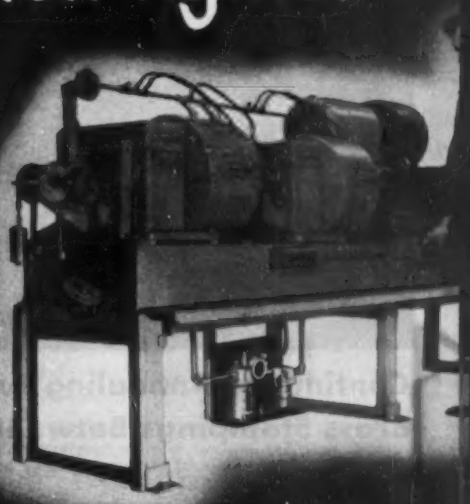
Press has a stroke of 20 in., adjustment 10 in., shut height 42 in., bed area of 48x48 in., capacity 200 tons, and operates at 12 strokes per min.

The pneumatic cushion in the bed has a capacity of 35 tons at 100-lb. air pressure, with 9-in. travel.

Cleveland Punch and Shear Works Co., Cleveland 14, Ohio

Sensational "Friction Fighter"

Alemite OIL-MIST Lubrication



✻ cut bearing temperatures from 110 degrees to 70 degrees!
lubricated 66 bearings daily with 1½ ounces of oil!
gained ½ hour's production time daily!

Now from Alemite—world leader in lubrication—comes this great friction fighting achievement. Alemite Oil-Mist! The most efficient, continuous, fully automatic system in the field of machinery lubrication.

Alemite Oil-Mist! The System that atomizes oil into *mist*—distributes it through tubing to bearings—bathes *all* bearing surfaces with fresh, clean, cool oil film. A system that simplifies and materially cuts the cost of machinery lubrication. And the lubricator unit has no moving parts.

Oil-Mist uniformly maintains oil film on plain and anti-friction bearings, gears and chains *regardless of variations in load, temperature or speed.* Eliminates the "human element."

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Lubricates All Types of Mechanisms

✻ Here's Proof of Oil-Mist Results Direct from a Field Report!

Before Oil-Mist: It took a full pound of grease and 30 minutes "downtime" daily to lubricate a highly specialized machine at a wire and cable manufacturing plant. 32 of the machine's 66 bearings couldn't even be reached for lubrication, and the average bearing temperature was a hot 110 degrees.

After Oil-Mist: Lubrication of the machine is now fully automatic with a saving of 30 minutes production time daily. Just 1½ oz. of oil lubricates *all* 66 bearings and bearing temperature is now only 70 degrees. Life of bearings is greatly extended!

Alemite OIL-MIST Lubrication

Check All These OIL-MIST Advantages!

- Continuous, uniform lubrication of all bearings.
- Air pressure seals bearings against dirt.
- Reduces oil consumption—up to 90%.
- Prevents product spoilage.
- Eliminates guesswork—each bearing picks up as much Oil-Mist as it needs.
- Reduces starting and running torque.

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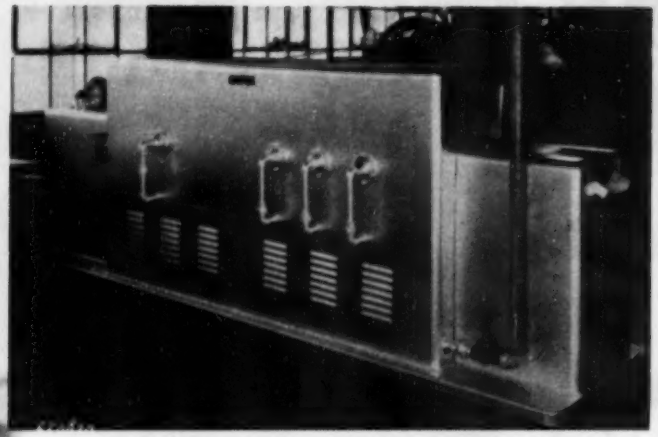


Continuous Annealing Furnace for Brass Stampings Between Draws

Furnace is gas-fired by eight burners with individual mixers. The combustion blower, control valve, gas regulator, and variable-drive mechanism are mounted within the casing. The small, rubber - tired wheel, shown at the extreme left, drives the belt by pressing it against the large ball-bearing-mounted idler pulley.

The furnace can be built in any size and either open or controlled atmosphere, full muffler type.

Waltz Furnace Co, Dept A, 1901 Symmes St., Cincinnati, Ohio

Low Heat, No Pressure Needed to Join Metals With Organic Bond

A bonding agent known as Chemo-Tec is able to join metals to each other, to similar or dissimilar metals, or to non-metallic materials such as ceramic, glass, or wood. Available in rod, powder, paste, and liquid forms, it is able to join titanium, magnesium, aluminum, and similar difficult-to-bond metals.

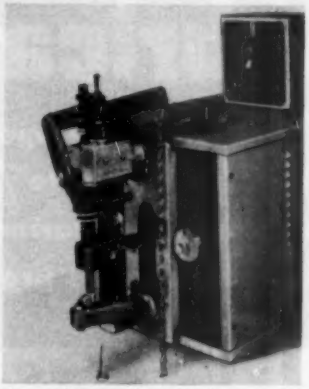
In rod form, it is applied with a welding-rod techinque, but at a much lower heat. It bonds by capillary and chemical action, has high fluidity, and its excellent wetting characteristics enable it to penetrate all but sealed joints. The bonding agent is based upon a new organic compound Araldite developed by the Ciba Co. To this is added metallic powders, resulting in a compound which exhibits inertness, good strength, low shrinkage, and good bonding properties. Tensile strengths in excess of 5000 psi have been obtained.

The application of heat sets up a chemical reaction which changes the molecular structure and fuses the bonding material. The bond at the interface is equal to the tensile strength of the bonding material itself.

Maximum strength is obtained from close-fitting joints, and a joint clearance of from 0.004 to 0.008 in. should be maintained. The part to be joined is heated to approximately 250 to 300 F. The rod acts as a temperature indicator and sufficient material is applied to effect the joint.

There are four steps, for example, in the use of one of the agents known as ChemoTec 701 in the powder form. They are: (1) Thoroughly degrease the surfaces to be joined. (2) Dust powder onto the surfaces to be joined. (3) Contact pressure is sufficient, but jigs should be used to hold products in position during heat treatment. (4) The bond must then be fused by subjecting the parts to heat as per the following schedule: 24 hr at 250 F, 10 hr at 270 F, 2 hr at 320 F, ½ hr at 400 F, 7-10 min at 490 F, and 2-4 min at 530 F. No flux is needed, and heat may be applied by oxyacetylene torch, gas and air torch, propane torch, furnace, infra-red, resistance heating, induction heating, or in the case of some of the agents, at room temperature.

ChemoTec Division, Eutectic Welding Alloys Corp, 172nd St & Northern Blvd, Flushing 58, NY



Electrode-Travel Control On Resistance Spot Welder

This resistance spot welding and soldering machine features a quick adjusting device for pressure control and length of electrode travel. Known as the Model 5000 WVS, it spot welds steel parts up to 3/16 in. in thickness; spot welds copper to bronze, copper to copper up to 0.040 in. and brass to brass up to 0.080 in. It will solder brass up to ¼ in. in thickness as well as sterling silver and other precious metals. Equipped with timer, that operates on 220 v ac, 25 amps, and is equipped with water-cooled electrode.

The electrodes are spring-action controlled so that when electrode arms are closed, work is held firmly in position. The automatic cut-off timer regulates soldering time. The heat control has eleven adjustments. When dials are set in uniform soldering time, heat, and holding pressure on the electrodes are maintained regardless of how long work is held between the jaws.

Joyal Products, Inc, 56 Belmont Ave, Newark 3, NJ

30% MORE PRODUCTION
40% MORE JOBS WITH

STERLING SPEED-TROL!

Replacement of single speed motors with Speed-Trol variable speed drives on punch presses at the Los Angeles factory of Square D Company resulted in the following advantages, reports L. C. Maechtlen, Vice President: Production increased 30% ... spoilage or rejects reduced 10% ... presses adapted to 40% more jobs ... 100% synchronization of punch press speed and operator's ability ... employee morale greatly improved.

STERLING SPEED-TROL GIVES YOU VARIABLE SPEED CONTROL NECESSARY FOR:

EQUIPMENT ADAPTATION TO: Sequence synchronization—operators' abilities—load variations due to differences in quantity, quality, weight, size, tension, hardness or shape of material to be processed, machined, conveyed, blended, mixed, etc.

PROCESS CONTROL OF: Temperature—viscosity—level—pressure—flow—etc.

TIME CONTROL OF: Baking—drying—heating—cooking—pasteurizing—soaking—chemical action—etc.

With Speed-Trol you get the maximum in production, plant efficiency, quality and profit.

OTHER STERLING ELECTRIC POWER DRIVES:
• STERLING SLO-SPEED (GEARED) MOTORS
• STERLING KLOSD AND KLOSD-TITE (NORMAL SPEED) MOTORS
DRIP-PROOF • SPLASH-PROOF • TOTALLY ENCLOSED

70 ILLUSTRATIONS showing how Sterling Electric Power Drives reduce production costs. Write for Bulletin No. B-100.

OUTSTANDING FEATURES:

Infinite speeds—positive speed regulation—fingertip control—large indicator—positive pulleys—no springs—belt tension in proportion to load—protected—streamlined—Herringbone Rotor—through ventilation—versatile mounting—NEMA dimensions—shock absorbing—quiet operation—rugged—compact—dependable—long life.

STERLING ELECTRIC MOTORS

Plants: New York City 51; Van Wert, Ohio; Los Angeles 22; Hamilton, Canada; Santiago, Chile.
Offices and distributors in all principal cities.

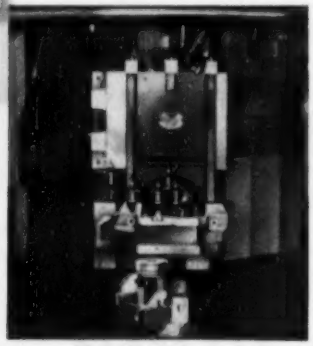
Cutting Mechanism Completely Enclosed On DeWalt Machine

The DeWalt ME-1 high-speed metal-cutting machine offers complete operator protection—the cover totally encloses the wheel, work, and belt drive.

It employs either a saw blade or abrasive wheel to cut off ferrous and non-ferrous bar stock up to 3 in., light-wall steel tubing up to 4 in., flat bar stock up to 1x4 in., and extruded or small structural shapes up to 4 in. on a side. The motor is 10 hp and spindle speed 3425 rpm.

Other features include an operator's handle adjustable to suit arm stroke; automatic return of cutter after stroke; six V-belt drive; plunger lock enables arbor nut to be removed instantly.

DeWalt Inc, Lancaster, Pa.



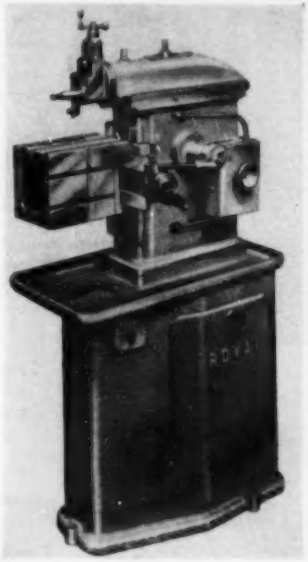
4 ¾-In. Threads Rolled In Machine's Normal Cycle

These attachments which operate on the cross-turning slide of the Bullard Mult-au-matic roll large-dia threads in the machine's normal cycle time.

Because threading and other machining operations are performed without rechucking, there is no loss of thread alignment, and necessity for moving the part from one machine to another is eliminated.

A 4¾-in.-12 thread can be produced on close-tolerance rocket parts. Previous production required a separate operation, as well as 100% inspection to assure exact alignment. Thread surfaces are so uniformly and accurately maintained in high unit production of the part that simple spot inspection suffices. Salvo attachments insure greater squareness and a much higher degree of surface finish on the threaded length.

Salvo Tool & Engrg Co, 26441 Gratiot Ave, Roseville, Mich.

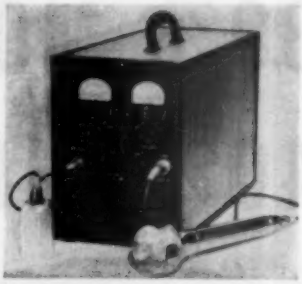


Royal 10-in.-Stroke Shaper

Among the advantages claimed for this British-built machine are compactness, low power consumption, large metal-removal rate, and low cost ($1050 FOB Philadelphia, with motor and vise).

The swiveling box table has three T slots in the top face and in one side has two horizontal T slots and a vertical V groove for holding round bars. The toolhead swivels through 120°. Power feeds to the table both transversely and vertically. The motor is three-phase 60-cycle, 200 v. Imported by:—

The Hall Tool Co, 5120 Market St, Philadelphia 4, Pa.



Balancing Machine Measures Vibrations, Locates Source

Model 652 Vibration is a portable electronic machine for the analysis, evaluation, and correction of vibration. The unit measures without computation the amplitude and frequency of the vibration, and discovers the source by means of a stroboscopic light. It consists essentially of a vibration pickup, a multi-channel electronic circuit, and a stroboscopic lamp, and operates on 110-v 60-cycle current.

As production balancing equipment, the Vibratron can be integrated with a test stand for economical dynamic balancing of rotating parts in the range from 600 to 40,000 rpm, or as a final production step in balancing complete machines before shipment. By means of a four-step switch in the amplitude circuit, meter readings can be obtained in full scale from 0.0001 to 0.1 in. peak to peak.

Feature of the model is its unusually sensitive velocity-type vibration pickup, which will stand repeated drops on concrete floors without failure or loss of accuracy. Pickup output is 82 mv at 0.001-in. deflection at 60 cps. Unit will balance everything from 1-oz. armatures to 200-hp generators.

International Research & Development Corp, 908 West Third Ave, Columbus 8, Ohio

Push-button electric switch, weighing only one oz, is sealed against entrance of oil, water, and dirt by synthetic sponge rubber. Movement required to operate snap-acting switches is provided by resilience of the seal; no sliding joints are required. Single- and double-pole assemblies listed for 5 amps, 250 v ac; either type will control 30-v dc inductive loads of 2 amps at sea level, and 1½ amps at 50,000-ft above sea level.

Micro Switch Div, Minneapolis-Honeywell Regulator Co, Freeport, Ill.

What do you do when you don't have the right size v-belt in stock?

1 **Contact your supplier for a replacement**

...and wait for delivery

...wait—and watch production stay at zero

2

Send someone to get the required belt

...and pay your employee while he goes for the belt

...pay through loss of production

3 **Stock VEELOS...**

...and always have the *right size* belt when you need it

...any length can be made up from a 100-foot reel

...inventory is automatically maintained

...available from 350 distributors

GET ALL THE FACTS

This Veelos Data Book gives complete details about construction, installation and uses. Write for free copy of this money-saving book today.

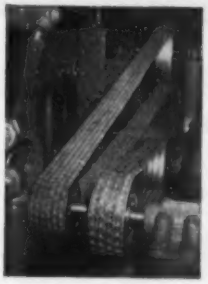
MANHEIM MANUFACTURING & BELTING COMPANY
601 Manheim St., Manheim, Pa.

VEELOS in stock is Production Insurance

Belts for replacement always on hand—just 4 reels of Veelos in the 0, A, B and C widths can replace up to 316 different sizes of endless v-belts.

Link construction permits quick installation—without removing outboard bearings.

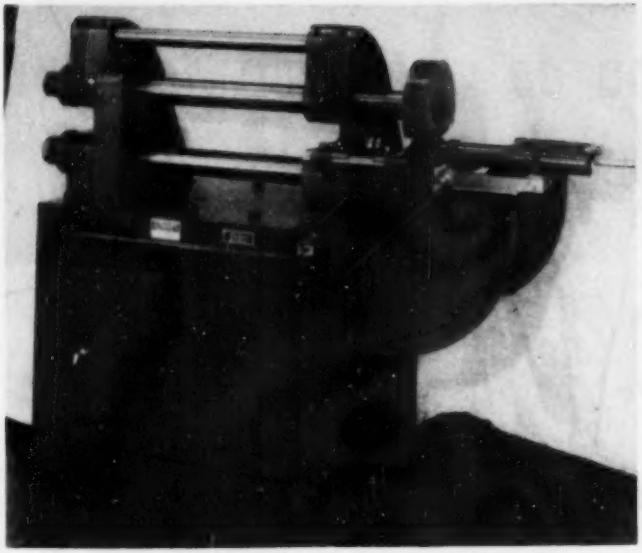
Adjustability provides controlled tension on each belt—vibrationless, full power delivery is assured.



VEELOS THE LINK **V-BELT**

ADJUSTABLE TO ANY LENGTH · ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in 0, A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

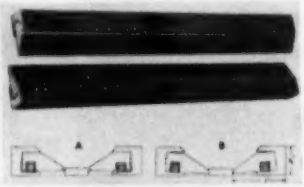


Carlson Wire Cutter Handles Any Length Required

Heavy-duty machine for cutting black-tempered and other straight wires is 62 in. long, 30 in. wide, and 57 in. high. Cutting capacity varies, depending upon the length of wire desired and operator, up to 150 lb per hr. It may be set to cut any length of wire required.

Two 8-in.-dia rotary cutters are made of ground high-speed steel and are of the tube type. Three-inch diameter shafting, turned and ground, runs in Oilite and ball thrust bearings. Machine is powered by 3-hp, 3-phase, 60-cycle gear-head electric motor.

Carlson Tool & Machine Co, Geneva, Ill.



Vise Hold-Down Fixture

The jaw recess surfaces of these hold-downs are so designed that when vise pressure is exerted the jaws are forced down, gripping the work securely. A positive seating against the bottom and back recess surfaces takes place automatically, preventing any forward or sideway movement under cutting-tool pressures. This action is governed by the movement of the jaws up and down under spring control.

The jaws are made in three sizes: 4, 8, and 12 in. They are sold in pairs for $9, $12.50, and $18, respectively.

Ready Tool Co, 55½ Iranistan Ave, Bridgeport 5, Conn.

Sulfur-Free Cutting Agent Reduces Chip-Rupture Force

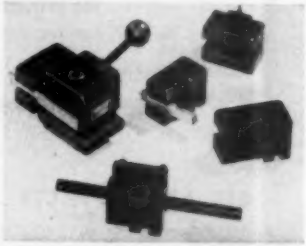
A sulfur-free metal cutting agent known as X-30 is claimed to increase tool life 400 to 800% and decrease RMS surface finish readings 35 to 50%. Its catalyst is an organic compound said to be non-staining and completely transparent. It is both odorless and nontoxic. Any regular paraffin or napthenic cutting oil can be used as its vehicle in ratios as high as 4 to 1.

The agent is said to limit and localize energy absorption in the work piece by increasing the internal lattice energy at the rupture area. Generally speaking, speed should be doubled in the feed adjustment, so that the cubic-in. per min of metal removed should be about the same as at the lower speed. This reduces movement to only those atoms immediately adjacent to the separation area. By this means, Btu's per cubic in. are reduced, prolonging tool life.

By giving up free atoms through heat generated by plastic deformation, X-30 causes a reaction with the metal at the rupture area similar to the brittlizing effect of nitriding or carburizing. The free atoms disassociated unite with those in the active metal lattice. The released atoms fill the voids in the metal's crystal lattice structure which are caused by deformation during the cutting operation. An embrittling effect results in the rupture area and, as a result, the metal responds to a much lower rupture force.

The phenomena can be observed in the machining of ductile steels with X-30. In these cases, the chips are broken into short, brittle lengths instead of coming off in long ribbon formations as is the case with conventional cutting oils.

The Metalloid Corp., Huntington, Indiana.



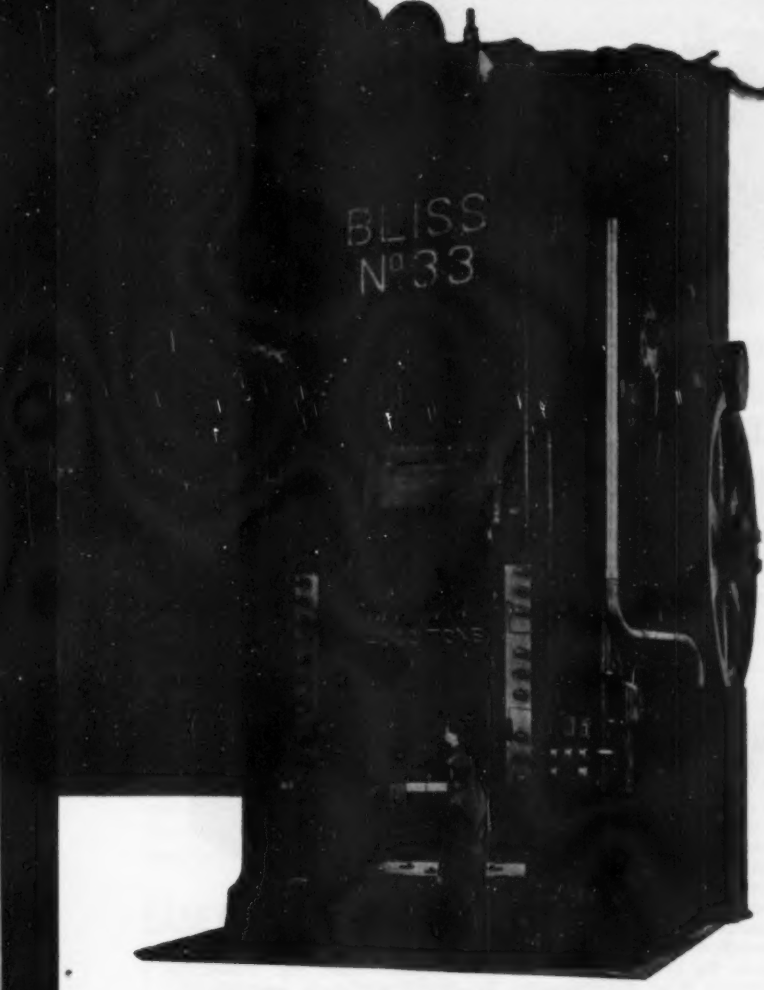
Tool Bit Adjusted Vertically Without Moving Bit in Holder

Tool holder, with component boring adapters, fits all standard engine and turret lathes.

Some of the features of the new toolholder include: vertical adjustment of tool bits can be made without the moving of bits in their holders; no shims needed for height adjustment of tool bits; positive repeating is made possible with unlimited number of tool bits or operations; tool bits can be removed with holder adapter for resharpening without changing setup; because tool bars are removed vertically, the necessity of moving the carriage back is eliminated; close tolerances can be held because the unit repeats within 0.003 in.

George F. Kirkelie Co., 8717 Darby St., Northbridge, Calif.

The trend is to more stampings with **BLISS** *Presses*



Largest knuckle-joint press in the world: bed area of 60″ x 70″, 40-inch die space, and six-station Bliss ratchet dial feed, 59″ dia., with electrical protection for safer indexing.

Bliss builds world's largest knuckle-joint press for Regal Ware, Inc.

When Regal Ware, Inc., Kewaskum, Wis., needed a press to coin cups for artillery shell cases, one press builder recommended a 6000-ton hydraulic. Bliss, who builds both mechanical and hydraulic types, found that a 4000-ton knuckle-joint press would not only deliver higher production but would also cost much less.

Result: Bliss created the largest knuckle-joint press ever built, a giant standing 34 feet and weighing 305 tons.

Regal Ware's experience is a good example of how press buyers can count on Bliss' unbiased recommendations. For Bliss builds more types and sizes of mechanical and hydraulic presses than any other manufacturer. Call in your nearby Bliss sales engineer today.

E. W. BLISS COMPANY, CANTON, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo, and Toronto, Canada. **West Coast Representatives:** Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Co., Seattle. **Other dealers** in United States cities and throughout the world.

Bliss

on your press is more than a name ...it's a guarantee!

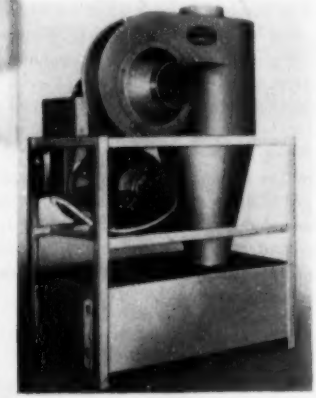
Murray-Way Automatic Head Polishes Turbine-Disk Slots

This head was developed for the fast, accurate deburring of turbine-disk slots, but can be converted by a few simple adjustments to a wide range of use. In the photo, four heads are in operation at various positions.

Head may be used with either wheels or buffs and is compact in design.

In the turbine-disk-slot operation two, three, or four heads are used as the work requires. Heads may be dropped or added easily if found necessary. The head may be positioned in any vertical or angular position.

Murray-Way Corp, 3925 West Fort St., Detroit, Mich.



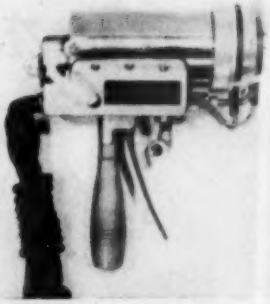
Over Drive for Low-Frequency Outside-Exhaust Dust Collector

The Model 30ND50 Dustkop dust collector provides for outside exhaust of cleaned air, together with an overdrive when used on electric power having frequencies of less than 60 cycles.

The unit fulfills requirements of certain state codes which make mandatory the outside exhaust of cleaned air from any dust source. The unit employs a standard size, pre-tested, cyclone separator, which removes the dust and dirt from the air and permits the discharge of the cleaned air, together with any toxic or objectionable fumes to out-of-doors. Access to the 12-cu-ft dust storage compartment is by doors at either end. The unit has a rated capacity of 3630 cfm at 6-in. static suction on an 8-in.-dia pipe. Supplied as standard equipment is a 5-hp motor for operation on either 220- or 440-v, 3-phase, 60-cycle power, together with manual starting switch which has thermal overload protection.

The unit is shipped complete, requiring no assembly at destination.

Aget-Detroit Co, 130 Main St, Ann Arbor, Mich



Nozzle Heating Element in Metal Spray Gun

This is an improved model of the Spray King, a compact, simplified spray gun designed for low-melting alloys and metals.

The latest model has an addition to the internal heating element, a nozzle element which prevents metal cooling at the nozzle and assures continuous, uniform spray. It is said that marginal alloys in the 500 to 650 F class will now be easily sprayed.

Capacity is 7 lb of low-melting alloy. Price is $250, FOB, Hillside.

The Cooper Alloy Foundry Co, Hillside 5, NJ

Chart Shadows Eliminated On Toledo Industrial Scales

Speedweigh scales for industrial packaging and check weighing are equipped with an over-size dashpot to eliminate indicator oscillation. Plastic dome on the chart housing admits light from both sides and top; front or side indications are free from chart shadows. Indicator travels one full inch to each oz.

Three capacities are available: model 3011 to 5 lb; 3021 to 20 lb; 3031 to 50 lb. Model 3021 requires table space of only 21⅝x11¼ in.

Toledo Scale Co, Toledo, Ohio

MINOR in size yet a MAJOR new addition to STANDARD DIAL BORE GAGES

YES, Standard Gage, pioneer of dial bore gages, has developed a still newer type of dial gage for quick, accurate inspection of small diameter bores from .250" to .375". The ultimate in precision gaging of small bores, STANDARD'S No. 00 is based on an entirely new "interchangeable disc" principle, surprisingly simple in design, easy to set and easy to use.

- Readily entered in bore
- Holds its setting
- Gives positive repeat readings
- High visibility dial graduations of .0001" are easy to read

Sapphire tipped gaging plunger and chrome-plated centering-size discs insure a long, trouble-free gaging life.

NEW #00 uses centering-size discs for checking bores from 1/4" to 3/8"

★ Designed for tolerances up to .005"
★ Sapphire tipped gaging plunger
★ Chrome plated centering-size discs assure long "precision-service"

Photograph actual size

Patent Applied For

Enlarged diagram shows easy assembly of centering-size disc on plunger.

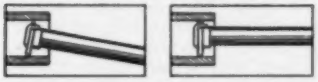
New centering-size disc

A turn of the knurled clamping nut releases centering-size disc or locks it firmly in place.

EASY "SIZE CONVERSION"

Conversion to various sizes in the range from .250" to .375" is accomplished by the quick interchange of centering-size discs on the same head by the one-step operation of turning a clamping nut. Positive locking action of this nut insures holding set dimension. Centering-size discs are furnished to suit dimensions of bore to be checked. No. 00 will check to within 1/16" of the bottom of a blind hole.

EASE OF OPERATION



Gage is entered at an angle to allow extended plunger to clear the bore, then rocked to cause plunger to pass a square position while noting minimum reading on the indicator.

When ordering be sure to state nominal size of bore and tolerance desired

Now 8 sizes cover range of 1/4" to 16" in STANDARD'S line of Dial Bore Gages.

Write for new complete Catalog C showing these and other gages.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

PERSISTENT IN PERFECTION . . .

Your goal is a perfect job. Only the best of materials, the most careful workmanship, and the finest of tools are good enough for you. And you are quick to recognize the work of other *real* mechanics who, like yourself, are persistent in perfection.

Perfection is the standard to which Bonney wrenches are made. Mechanics call them America's finest—unmatched for lightness, strength, balance, and precision.

Bonney wrenches are the pride of the men who make them . . . the pride of the men who use them.

BONNEY TOOLS

Persistent in perfection, refrigeration equipment manufacturers like Carrier, Frick, Norge, York, Refrigeration Corporation of America have revolutionized the processing and preservation of food.

BONNEY FORGE & TOOL WORKS • ALLENTOWN, PENNSYLVANIA

ROUND TABLE Discussion

DOUBLE TROUBLE

What is the best way to bring about cooperation between double shifts? Does a night crew tend to be more careless with machines, more thoughtless about leaving things in good shape for the next shift? Some opinions . . .

WE ALL HEAR about the night shift; everything that happens is blamed on them.

It is natural that the night shift should have more trouble; the personnel is not so well trained and, as a general rule, there is less supervision. In most plants seniority has the preference, and the night shift has to take what's left.

Placing new men directly on the night shift is a mistake. They should first be trained on the day shift; when fully trained, they will do a much better job.

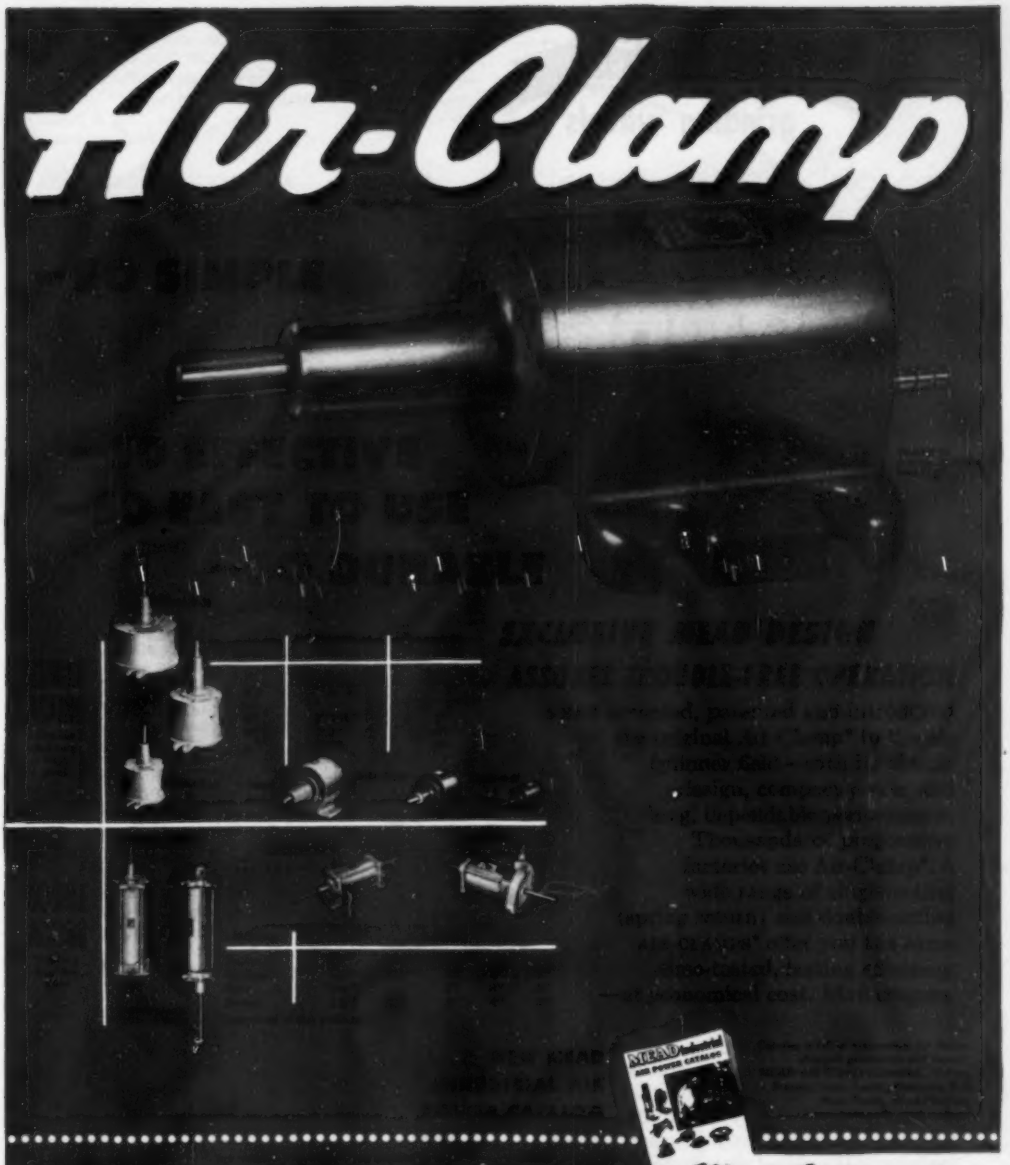
There are some plants that work alternating shifts. This method is very efficient, as the supervision also moves over with the shift. On alternate shifts there is an equal distribution of skilled and key men.

I have often found it necessary to spend some time with the night shift. It affords opportunity to view things from a broader perspective, in addition to keeping in touch with the personnel on all shifts. There is less friction between shifts when someone in authority works between them.

There are many ways to jack up the morale of the night-shift worker:

1. See that he is provided with the proper tools, equipment, and lighting.
2. Make him understand he is an important cog in the shift.
3. Have the day-shift worker change places with him on special occasions such as anniversaries, dances, parties, and family gatherings.
4. Get his ideas and advice on subjects connected with the shift.
5. Give credit for a job well done.
6. Find out if he has transportation difficulties, and, possibly where to find someone to ride to work with.
7. Let him call his home on special occasions; this works wonders.
8. Show sympathy for his problems.

Air-Clamp



MEAD

AIR OPERATED DEVICES

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., DEPT. MA-102, Chicago 41, Ill.

Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

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SIMONDS
ABRASIVE CO.
grinding wheels

ALL'S HARMONY
in the grinding department

For better output, these boys know the score. It's Simonds Abrasive Company grinding wheels for the stepped-up tempo of defense requirements. Simonds complete line has everything to keep *your* production in tune with today's needs . . . grinding wheels for every operation, mounted wheels and points, segments and abrasive grain . . . top quality products backed by Simonds Abrasive Company's reputation as a major grinding wheel manufacturer for almost 60 years. Write for free grinding data book listing name of your Simonds distributor.

SIMONDS ABRASIVE COMPANY PHILADELPHIA 37 PA. DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simond's Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

In conclusion, my suggestion is to see that some key men are on the night shift, and that other workers are trained on day shift before being assigned to night work.

A E Salmons
Philadelphia, Pa.

ALCOHOLICS FORALLEVUS

Is it possible to enforce a rule against daily use of alcohol by plant workers? Is it practical, particularly if a man's work is not affected by such use, and enforcement may result in the loss of a good worker? Readers think . . .

"There is so much good in the worst of us,
And so much bad in the best of us,
That it ill behooves any of us
To find fault with the rest of us."

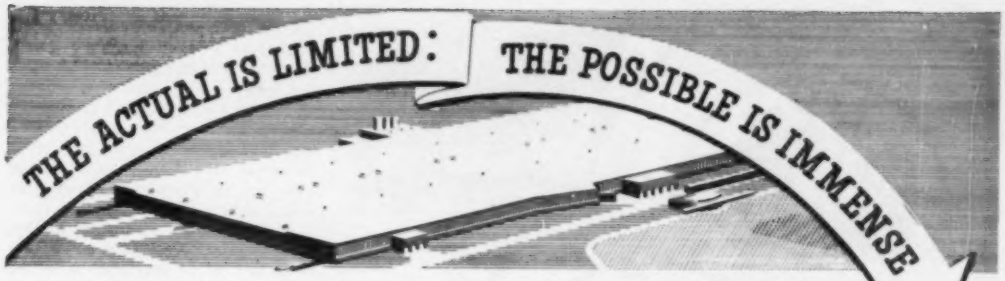
THAT IS A wise motto to keep in mind before we permit our little personal distastes to affect our fair appraisal of a man's work.

However, some distinction is necessary in classifying objectionable personal habits. The garlic eaters, cigar smokers, and infrequent bathers may offend some people because of their questionable personal habits, but the chronic alcoholic in the shop is certainly outside of the questionable category.

Shop rules nearly always provide instant dismissal for any employee found under the influence of liquor, or who brings intoxicating liquor onto the plant premises. This rule should be rigidly enforced or discipline will suffer. Coming to work drunk is displaying a lack of common sense and a total disregard for shop rules. A good man-to-man talk by the foreman for the good of the shop is necessary on the occasion of the first offense. It may send the errant worker back to work with a new realization of his responsibility to the shop and his fellow workers. When the offense becomes chronic, dismissal is the only course to follow.

Chronic alcoholics are enough of a problem without letting them into the plant. They seriously affect production and safety if allowed to continue on the job. Other objectionable personal habits of workers, such as smoking at work or infrequent bathing, while annoying and possibly cause for some action on the part of the foreman, do not merit the drastic action that drunkenness entails.

It is believed that the fair-minded foreman will not permit personal distaste to affect his judgment of the worth of an employee, but he cannot



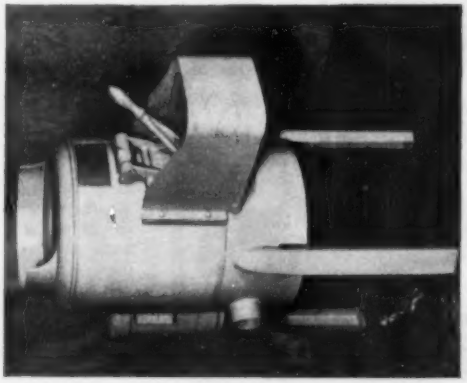
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1952

BUILDS STRONGER MORE RIGID MACHINE BASE

...cuts weight 36%, lowers cost 45%

By **A. H. Hallenbeck,** Plant Manager
Gifford Wood Company, Hudson, New York



WELDED design has been adopted on many of our machine components because of lower cost and better quality production with steel. As shown in the welded base (Fig. 2), lower weight with steel now saves on material cost as well as in transportation charges. Welded steel can be fabricated with simpler skills, helping to eliminate production bottlenecks in the shop. Components are pre-machined on light, fast machine tools prior to welding, saving time and cost of operating heavier shop equipment as was the case with cast construction.

Through welded steel, our shop now has better control of its work schedule. We are no longer dependent on outside sources for castings nor contend with storage and maintenance of pattern equipment.

Welded design makes it possible to meet price competition in our field that we were unable to do with the original cast designs. The product has a more modern appearance to improve selling appeal.

Fig. 3—Feed processing machine *for the Gifford Wood Company, Hudson, New York. Streamlined appearance is simple to maintain, easy to clean.*

WELDED DESIGN ALWAYS SAVES STEEL AND LOWERS COST

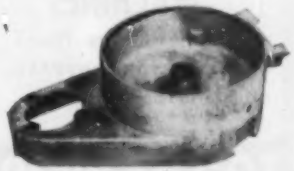


Fig. 1—Original Construction—*Base for processing machine. Weighed 67 pounds. Material Cost—$15.05; Machining Cost—$7.34. Total Cost $22.39.*

Fig. 2—Present Welded Steel Design—*Stronger, more rigid. Weighs only 43 pounds. Material Cost $2.50; Fabrication—$9.77. Total Cost—$12.27.*

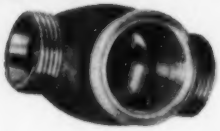
HERE'S HOW

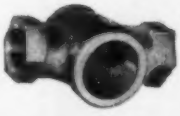
Machine Design Sheets available on request. Designers and Engineers write on your letterhead to **Dept. 109.**

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.





Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

●

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS & DeLEEUW

GOSS *and* DeLEEUW

MACHINE COMPANY, *KENSINGTON, CONN., U.S.A*

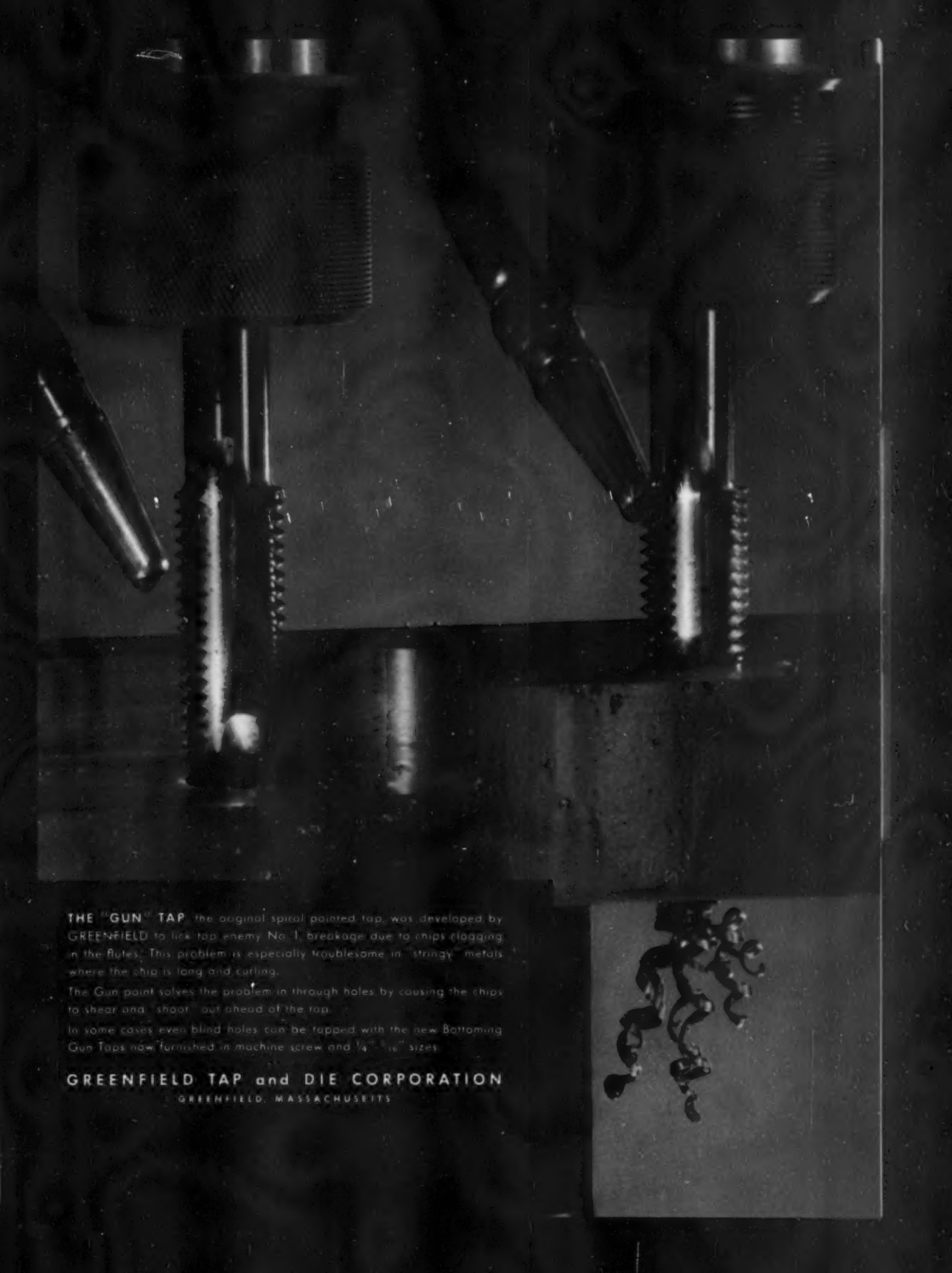
prevent other employees from taking offense at a fellow worker's objectionable personal habits. The basis for judging the value of a worker should be his ability and productive efficiency rather than what he eats and the way he eats, or how often he bathes. However, an objectionable personal habit such as chronic alcoholism is a horse of another color and demands drastic action. In this case, safety and production efficiency should guide the foreman in his appraisal of the worth of the worker.

Coming to work drunk is a demonstration of utter disregard for shop rules and discipline. The new philosophy of education in most of our schools aims at developing initiative and independence of thought in our younger generation. Children are allowed to do much as they please in school, and the strict schoolroom discipline of a generation ago is now considered unscientific. It is inevitable that as these children complete their schooling and go out into industry, their dislike of discipline, and indeed, any restrictions imposed from without, carries through with them.

During the last war, when employers were faced with tremendous labor turnover problems, there was a tendency to wink at many situations. Smoking on the job is just one example, and employees occasionally reporting for work under the influence of liquor is another example of such abuses. The lax discipline that has grown up in some of our plants, condoning smoking, drunkenness, loafing, insubordination, and other abuses of shop rules will require a long educational program and a waiting line in front of the employment office to bring about a change.

Nevertheless, it is important that management and labor cooperate in establishing and enforcing shop rules

"They want a window in their wall! They say if we don't get it for them, the union will!"



THE "GUN" TAP the original spiral pointed tap, was developed by GREENFIELD to lick tap enemy No. 1, breakage due to chips clogging in the flutes. This problem is especially troublesome in "stringy" metals where the chip is long and curling.

The Gun point solves the problem in through holes by causing the chips to shear and "shoot" out ahead of the tap.

In some cases even blind holes can be tapped with the new Bottoming Gun Taps now furnished in machine screw and 1/4" - 1/2" sizes

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

RUGGEDNESS AND REFINEMENT are two things you might not expect to find combined in one tool. You will find both, however, in GTD AMPCO End Mills.

The precision finish of the shanks, the uniformity of the cutting teeth, the exactness of size assure accuracy in use. Design, steel selection and precisely controlled heat treating give them their ruggedness.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

which, in the last analysis, are just as much in the interest of the employees as they are of the employer. Without shop discipline governing infractions and abuse of shop rules, no business could long exist in a competitive economy.

A fundamental of good leadership is that no order should be given which cannot be enforced; the same principle applies to shop rules. Most sensible employees realize the necessity for a shop rule prohibiting coming to work drunk and working under the influence of liquor. Endangering his own life as well as his fellow workers makes the alcoholic a problem for discipline.

In order to promote shop discipline and efficiency, a good foreman will endeavor to avoid placing men together who irritate each other or whose personalities clash. He will treat all individuals alike, regardless of their different backgrounds and national characteristics. The good foreman knows that nowhere can he find a supply of perfect workers; the foreman's job is to mold the human weaknesses of his men in the proper direction.

In the interest of running a safe and orderly shop, where the foreman fails to effect any change for the better in the alcoholic worker, as a last resort the matter should be referred to a discipline control board. The board may be composed of employees and executives who will pass upon the circumstances and either recommend discharge of the worker or decide to transfer the man to another department in the hope that new surroundings will improve his outlook and lessen his dependence on alcohol. The advantage of this procedure is that such a discipline board not only acts as a court of ap-

"Step up here on this stainless steel—this is going to be plenty messy!"

From finishing hardware . . .

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For the thousands of jobs where backstand belts can save you time, for the thousands of jobs other coated abrasives do so well, Armour has the answer – there's an Armour coated abrasive to do *your* job right.

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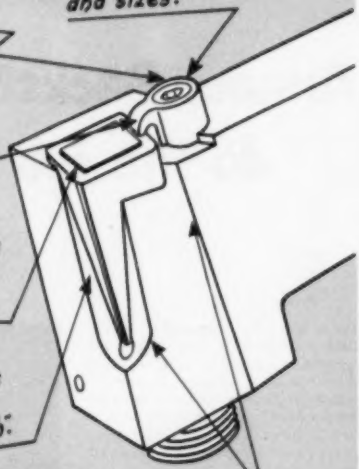
Here's Why the New TOP-CLAMP KENNAMATICS Give Top Performance

EASY TO GET AT— double end socket type screw permits release of clamp from either top or bottom.

SIMPLIFIED DESIGN— one rugged clamp and one sturdy screw for all standard tool styles and sizes.

EASIER TO INDEX— simply loosen clamping screw and clamp is up and away from insert.



CHIP BREAKER — most types can be used on insert without interference with clamp.

OPEN FRONT — provides added clearance and eliminates shank abrasion from "chip wash".

STRONGER — design provides greater rigidity. Insert is solidly backed up in direction of cutting force.

ALL Proved KENNAMATIC Features Retained!

- Indexable insert—positioned vertically—makes best use of Kennametal's high compressive strength.
- Simplified tool setting—insert has several cutting edges on both ends; can be revolved, turned end over end, or replaced without changing tool setting.
- Less grinding expense—resharpening merely requires squaring off ends of insert, and grinding chip breaker if desired.
- Available in all "industry standards" for wide range of jobs on various metals. Heavy duty styles also available.

KENNAMETAL Inc., LATROBE, PA., U. S. A.

peal, but assists in discipline control. The board is not set up for the purpose of punishing employees found guilty of serious misconduct, but as a means of preventing workers from violating rules that seriously affect the safety and well-being of all employees.

It is well to remember, when seeking to effect solutions to problems of shop discipline, that it is better to lean on the side of compassion than severity. Fairness and impartiality should govern disciplinary actions. "The hole and the patch should be commensurate."

Harry Kaufman
Philadelphia, Pa.

•

"'Won't you buy a motto
Just to put over the door?'
Asked the wifely little woman
Whose heart was very sore.

Her husband, to his whiskey flask
With visage grim and sour
Pasted this clipping from a hymn book,
'I need thee every hour!'"

APPARENTLY REYNOLDS is a man of this type, for a breath like his is not manufactured on good, cold water.

Booze can sap the energy of any man if he continues to indulge in it. If the offender seems unwilling to amend his ways, Al might refer him to the Personnel Department, if the plant has one. If there is none, then it is Al's task to try to straighten things out.

Back in the old days, a foreman once said, "There are three ways to get work out of a man. The first is to make him want to brace up and do his part; the second is to drive the work out of him. If this doesn't

"Boss, the blueprint calls for a 0.500 cut on a 30° angle."

Aesop's Fable of

"The Eagle and the Crow"

carries a moral for Cutting Fluid users

The Fable...

A Crow, sitting on a fence post, watched a huge Eagle swoop down on a luckless lamb and carry it away. "That looks easy", thought the Crow, and straightaway tried to duplicate the Eagle's feat. Of course, he couldn't lift the lamb and, instead, got tangled up in its wool and couldn't get loose. The farmer came over, grabbed the Crow, and wrung its foolish neck.

The Moral...

Just as there was a big difference in abilities of, and results secured by, the Eagle and the Crow in the fable, so are there big differences in the abilities of basically different types of cutting fluids. Stuart Oil Co., recognizing this, does not attempt to apply a watermixed cutting fluid where a straight oil is needed, or vice versa. Some applications require a fluid with great *lubricity*, on others high *anti-weld* properties are necessary. All require *temperature regulation*, but always *more than a "coolant" is needed.*

Let your Stuart Representative demonstrate the opportunities for increased machining efficiency in your plant. Ask to have him call at your convenience.

More Than a "Coolant" is Needed

D.A. Stuart Oil co.
EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

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Free! Dilut-o-graph

Circular slide rule makes dilution of cutting fluids quick, easy! For tanks of 1 to 100 gallons. Fill in coupon, clip to your company letterhead and mail to:

D. A. STUART OIL CO.
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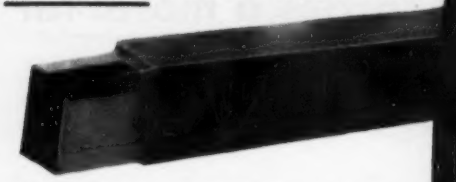
STANDARD TOOL ON SPECIAL JOB *Reduces* TOOL COSTS 65%



Here's what happened during an inside threading operation at an atomic special project. A special carbide cutting tool was being used for the job, which requires a No. 10 Acme thread in steel S. A. E. 1030. Everything went wrong, however. Tools were breaking, and the result was not one piece was completed.

Mr. Howard G. Frisby, Jr., representative of Choctaw, Inc., Memphis, came to the rescue. He furnished a Wendt-Sonis standard AR style carbide tool bit, turned it up sideways and reground it on the job. Breakage was eliminated, the job finished and tool costs reduced 65%.

YOUR CHOICE OF CARBIDE

When you choose Wendt-Sonis, you select the brand and type of carbide you want. You also select from a complete range of Wendt-Sonis standard tool sizes. All Wendt-Sonis carbide-tipped tools have rust-resistant tool shanks made from highest quality steels for greater economy and faster production.

***Free!* CHIP BREAKER CHART**

Contains illustrations of chip-breakers, grinding instructions and recommendations for their use. Chart size with tab for wall hanging. Write: WENDT-SONIS COMPANY, Hannibal Mo.

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BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL TOOLS

do the trick, the last resort is to scare it out of him by calling his attention to the possibility of loss of his job. If this fails, fire him, or lay him off for a period of time.

From the text it appears that Reynolds is a good man, but his present actions are certainly spoiling his opportunities. In addition, he should avoid annoying his neighbors at any time. They must be taken into consideration, for they might quit and leave Al shy of some good men—he'd be left short-handed.

Most men, such as Reynolds, will usually listen to reason. If he won't improve, the plant is better off without him.

Robert Lee Grayford
Worcester, NY

•

BLOWOFF

Can a foreman accept criticism from his men without losing face? If the criticism is legitimate, will the workers have more or less respect for the foreman if he takes it?

IT IS VERY difficult to say just how much a foreman should be willing to take from one of his men, because everything depends upon the personalities involved. There is the personality of the particular foreman involved, to begin with. Some men are phlegmatic, and others highstrung. There's a million miles difference between what a phlegmatic man can take, as against what can be taken by a highstrung man. It may be laid down as a primary rule that no foreman should attempt to take what he finds himself emotionally unable to take. If he does, it will work on his nerves to the point where it is liable to upset his equanimity in trying to deal with any and all of his men.

If, on the other hand, we assume that a foreman is phlegmatic, and is actually able to take what he feels he really had coming without getting into a stew over the thing, there still remains the personality of the other man in the picture to be considered. Judging from the conversation of Al and Ed in this particular case, it would seem Morton is a level-headed man who will not make his boast among the gang about telling Al off. If Al feels sure this is the case, and if he feels that he will be able to take it without becoming emotionally upset in his future dealings with Morton, or with others, it would be well to accept it. However, in such a case, it would be still better to go to Morton, tell him he realized he had been in the wrong,

ANYBODY
can weld it!

MAGNESIUM

That's right! If they can weld any metal, they can weld magnesium. Nearly all of the common welding techniques can be employed. Inert-gas shielded arc welding, gas welding, and electric resistance welding are all being used successfully on magnesium.

Most forms of magnesium are weldable. While joint strengths will vary with different alloys, typical properties of welded butt joints show tensile strengths up to 42,000 psi. and elongation up to 12%. In addition, magnesium welds are comprised of dense metal and are substantially free of microporosity.

The combination of relatively high weld strength and minimum specific gravity found in magnesium generally permits the design of welded magnesium structures that are lighter, stronger, and more rigid than is possible in other light metals. Dow has over 30 years of experience in the production and fabrication of magnesium —a call to your nearest Dow sales office will put this knowledge at your disposal.

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Magnesium Department • *Midland, Michigan*

New York • Boston • Philadelphia • Atlanta • Cleveland • Detroit
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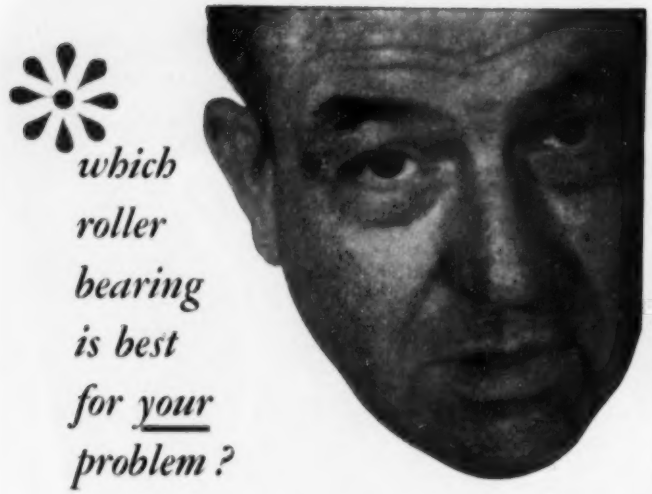
Dow Chemical of Canada, Limited, Toronto, Canada



which roller bearing is best for your problem?

. . . obviously one that is best suited to your machinery's particular requirements. You would want maximum capacity, smooth precision performance, long life, dependability with the least maintenance and of course an adequate range of sizes. McGill MULTIROL Bearings have been delivering this insurance for successful machinery for over 20 years. With today's increasing production demands it will pay you to specify MULTIROL. Write for complete information in the new McGill Catalog No. 52 today.

and, if an apology is in order, to make it.

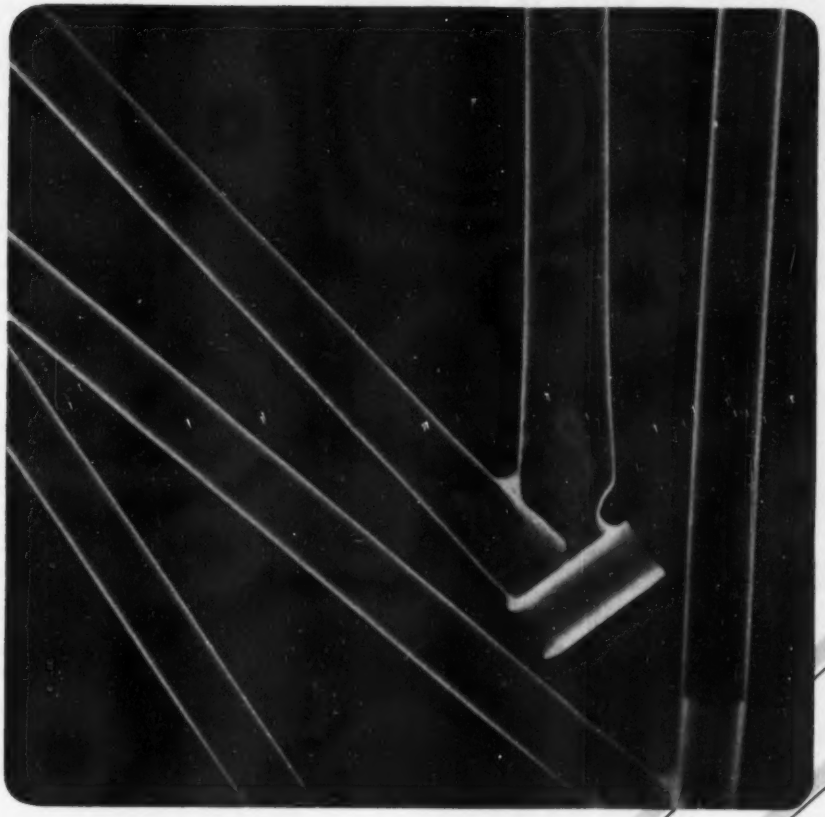
If it be first assumed, however, that such a course of conduct will lead to complications in the future, it might be wiser for Al to take the position of refusing to be judged by any of his workers. He might make it a point that the very fact he is in a supervisory position makes it essential that his authority be recognized and unquestioned, even in points where he might chance to be in the wrong, as any man is liable to be now and then. Undoubtedly the best course of conduct in any such case is the one which will disrupt production as little as possible, and allow the entire group of men involved to get along as well with one another as possible.

However, if Al feels that with his particular emotional setup he cannot take what has been handed to him by Morton lying down, and feels he must take a firm stand in the matter in order to bring about the above-mentioned results, it still should not prevent him from taking the lesson deeply to heart, and from watching himself more carefully in the future to avoid being placed in a similar untenable position.

Most of us, who are capable of learning at all, learn deeper lessons in the school of hard knocks than we learn in any university. This is one of the hard knocks that Al is liable not to forget for a while. Even though he feels he cannot consistently allow Morton to call him a jackass, or to insinuate that he is one, he may still pass judgment upon himself, and determine not to

"With current prices, one of the bright spots of our organization is our scrap potential!"

Radiography checks—



then double checks

LANDING GEAR STRUTS lead a life of punishment. Though light, they must be strong. Their joints must be sound. Radiography is the method used to prove them sound.

A maker of amphibian aircraft goes even further. Though treated and sealed, strut members can develop internal corrosion and become weakened. Radiography alone can provide the required nondestructive examination of these internal surfaces. So it has become routine to x-ray these struts as part of the periodic inspection of the planes.

This is but one example of how radiography is proving a boon to the welding process. It is helping to open new fields for the use of welding—especially in the fabrication of highly stressed products and assemblies.

Look into the ways Radiography can aid your business. Your x-ray dealer will be glad to give you full information and assistance.

EASTMAN KODAK COMPANY
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Radiography—

another important function of photography

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Do Your Jobs
EASIER-FASTER
with
Jarvis
FLEXIBLE SHAFT MACHINES

TAPPING ATTACHMENTS
TAPS · FLEXIBLE SHAFTS
AND MACHINES
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REAMERS AND MILLS
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Whether your operations call for GRINDING, CUTTING, BUFFING, or ROTARY FILING, Jarvis Flexible Shaft Machines will do your jobs Easier—Faster and more economically.

Available in Bench, Floor or Overhead types—in Single or Multiple Speeds to suit your individual requirements.

Jarvis Factory trained representatives are ready to assist you select the Machines you need. For further information and Catalog of Jarvis Flexible Shaft Machines, write directly to The Charles L. Jarvis Company, Middletown, Connecticut.

Jarvis POWER TOOLS

THE CHARLES L. JARVIS CO.
MIDDLETOWN IN CONNECTICUT

make any future foolish moves that will again put him into a similar position.

John E Hyler
Peoria, Ill

•

It is a very curious thing about criticism that while we are on the receiving end—no matter who the critic may be—we all feel a certain amount of resentment. I suppose the truth of the matter is that a man's ego hates to recognize the fact that in any form of criticism there is bound to be a certain amount of truth. Sometimes the pill is sugar-coated, which makes it easier to swallow, and sometimes we feel the medicine is very bitter indeed, especially if we have the idea that the critic, being in a subordinate capacity, should recognize his "inferior" station and leave our precious ego alone!

Which is precisely the situation Al finds himself in. In his shoes some of us might react differently to Morton's criticism, depending on the type of person we happen to be or how we happened to be feeling at the moment. Some foremen I have known would have sent Mr Morton packing, but the majority of them—and over the years I recognize them as the most capable—would have taken the criticism from whence it came and most certainly used it to good advantage.

I have in mind an incident that occurred some years ago which may serve to illustrate how the level-headed formean can deal with a blowoff and still not lose his temper and, possibly, a competent workman. I had occasion to go into a jobbing shop about some work that was in process there and on the threshold of the foreman's office I found myself listening to the tailend of an altercation between the boss and one of his men, who appeared to be hot under the collar, judging by his choice of language. The boss was listening calmly and polishing his eyeglasses while he listened. Finally the orator paused for breath and my friend got a word in.

"Say, Bill," he said with a twinkle in his eye, "I wonder if you talk to your wife like that."

For a moment there was silence in the office, then Bill grinned, threw up his hands in a "what's the use" manner and walked out. I suppose my face registered my interest in the little tableau, because Mac said with a grin, "Don't mind Bill, guess he had too much weekend. He's a good guy and 'long about the middle of

the week he'll be in to borrow five till payday!"

I thing the saving grace of humor can help to leaven the relationship between supervisor and subordinate in even the most strained circumstances. Of course, if the supervisor has a stuffed-shirt attitude toward his men there is very little hope for him. I doubt if the words of the Scottish poet could ever penetrate his self-importance. "O wad some power the giftie gie us, to see oursels as ithers see us!"

Robert S Alexander
Greenville, RI

•

IT IS EVERY man's right to suggest or criticize without fear of reprisal. Everyone, regardless of rank, makes a mistake at some time. We lose nothing by admitting our mistakes.

Many of us are good leaders most of the time; it is the few times we fail that spoils everything.

We do not always agree with members of our own family, or, for that matter, our best friends. That is a good thing to remember in the shop —treat all employees as you would your best friend in any difference of opinion.

When the employee doesn't like the way he has to do a job, ask him how he would do it. When a worker comes to you sputtering with anger or resentment, try this magic phrase. Begin by saying: "I don't blame you for feeling this way; if I were in your place, probably I'd feel as you do." An answer such as this will cool him off quicker than anything else I know. Then listen attentively to whatever the complaint happens to be.

Poor leadership would say, "I don't care what you think." Good leadership explains the reason why the job is done that way, or the rea-

"I hear the company has just hired a new Rate Setter."

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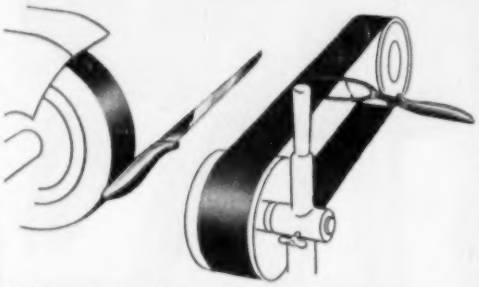
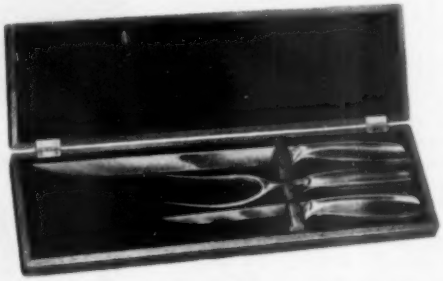
How would you SOLVE IT?

PRODUCTION PROBLEM: To cut unit costs of finishing cutlery sets and produce a more uniform finish. (Manufacturer was using set-up wheel method which finished only four blades an hour, left unsatisfactory finish.)

SOLUTION: 3M Engineering suggested that Gerber Legendary Blades of Portland, Oregon switch to the 3M Backstand Method, using Three-M-ite and Tri-M-ite Cloth Belts. This new method is currently *turning out 27 blades an hour*—six times the previous production!



KNIFE HANDLES' delicate lines and compound curves are brought out quickly, easily—**FORK TINES'** desired sharpness is easily produced. 3M Backstand Method gives the workman *complete control*. Lets him do better work in less time—every time.



RESULTS: Carving sets of matchless beauty finished at lower unit cost! 3M Sales Representatives can help *you* solve your grinding problems, too. Send coupon for facts.

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"3M"® Adhesives • "UNDERSEAL"® Rubberized Coating
"SCOTCHLITE"® Reflective Sheeting • "SAFETY-WALK"® Non-Slip Surfacing

son for some change. In many cases the employee does not have a picture of the ultimate objective.

Business is a mixture of bad days and good, victory and defeat, give and take. We know that he who loses his temper usually loses. Carrying a chip on our shoulder is the easiest way to start a fight. We learn not to carry tales, gossip, or pass the buck. We discover that getting along with employees depends 95% on our own behavior. Each employee is important, each has his own specialty according to his own talent and abilities. By recognition of each employee's good qualities we weld an organization of accomplishment and mutual advancement.

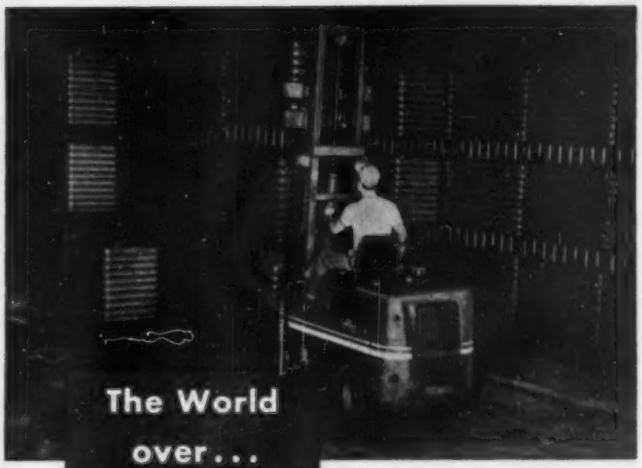
A E Salmons
Philadelphia, Pa

•

A FOREMAN should consider himself very fortunate if the men in the shop voice their criticisms and suggestions to him. Many times there is a tense atmosphere in the shop and the foreman would like to know its cause without pumping the men. If they knew that the foreman appreciated constructive criticism, one of them would soon let him know the nature of the disturbance.

In the setting up of a new job, the foreman should get the benefit of his men's experience by allowing them to offer suggestions. Some men are chronic gripers or first-class sidewalk superintendents and can aggravate the foreman with their constant complaints or spur-of-the-moment suggestions. A good foreman should be capable of separating the wheat from the chaff. He should develop the science of recognizing legitimate beefs or worthwhile suggestions. He should use discretion in appointing an advisory board consisting of various employees in accordance with their experience or popularity. Certain employees should

"Thanks, Bill. That darn thing's been stuck for ages!"



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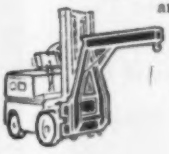
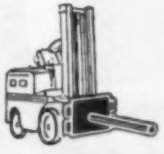


For full information on this more efficient modern method, consult the Clark dealer in your area. You'll find him a competent counselor on all problems of handling materials at lowest cost. Call him today—he's listed under "Trucks—Industrial" in the yellow pages of your phone book.



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WL steels are metallurgically constant. This guarantees uniformity of chemistry, grain size, hardenability—thus eliminating costly changes in heat treating specifications.

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be contacted for technical information and others for personnel relations.

A foreman might walk through the shop one morning kidding his men and not realize that one of the men became offended by a remark made in jest. This employee will become sullen and his feeling will begin to affect other employees. The foreman might never know what affected his production that day, or why some of the employees were in a dark mood. If an employee notified the foreman, it would be an easy matter for him to quickly make amends and correct the situation. The foreman should never hesitate to humble himself when it becomes necessary to maintain good relations.

Discretion is also required on how humble and how often a foreman should bow to the worker. If he becomes too humble, he might lose some of his respect. If a certain employee delights in aggravating the foreman, the foreman should use tactics to get the employee to cease, or arrange for his dismissal. One obnoxious employee can upset the emotions of twenty employees as well as the clear thinking of the foreman.

Frank J Zarnowski
Rutherford, NJ

•

THERE ARE times when situations arise wherein a worker must give vent to his feelings or else there's going to be hell to pay in the poor chap's subconscious. One of these times in particular is when the foreman steps off the line of executive behaviour and, as Morton would say, becomes a two-legged jackass.

It would be interesting to know just what brought about the outspoken worker's eruption, as it would give us a clue so that we might analyze further. We do know that it is far better to bring any disagreement out in the open than to let it embed itself in smouldering resentement. There are too many men going around patting their bosses on the back even though they know what is needed is a good, swift kick in the pants to put right that which is known to be wrong. I've seen too many men rip their bosses up the back when out of hearing and then put on their Sunday smile when in their presence. To be honest doesn't infer familiarity by any means.

I don't mean by that a man should be a target for unnecessary abuse, but if he has something coming to him, let him take it like a man and be magnanimous about the whole deal. One should not harbor resent-

ment; this not only results in productive inactivity, but lays the foundation for physical and mental ailments. Better be open about any disagreement and place the cards on the table, face up, and arrive at an honest conclusion—not as to who is right but what is right. Herein both will receive the benefit.

One of my former bosses was an unusual man in this respect. He had two important things to impart to new machinists upon hiring them. "Now I want you to know that we use the 13-thread standard here," he would say seriously, "not the 12. Another is that if you have anything to say to me, say it, and don't be afraid to. If I'm wrong, I want to be told about it, and you can bet your Uncle Dudley if *you* are, I'll let you know."

That man got along fine with the boys and commanded their highest respect. He was sincere, tolerated no familiarity or monkey business, and he knew his work. Whenever he was informed that he was in error, he took it like a man and expressed his appreciation for being told.

Fertilizing criticism, not the horse-feather variety, is what makes men grow in more ways than one. A man who refuses to be judged by his workers should find himself a job on the other side of the pearly gates.

J Homewood
Ontario, Calif

•

AL SHOULD consider that leadership is not something which one can mentally demand in the evening as one goes to sleep, and wake up tomorrow morning as one of the masters of men.

No, it will be a growth of the facil-

"Just wait until you see our novel materials-handling system."

A *better* Lathe from any *angle*.

(1) "Zero Precision" Tapered Roller Bearings—the best Timkens on any lathe. (2) Large collet capacity with choice of Center Distance. (3) Hobcut gears throughout for smooth operation. (4) Morfero full double wall apron. (5) Bed—box section, tapered, has an engineered backbone. (6) Two V-bedways to spindle for greater pulling power. (7) Holds precision accuracy for years.

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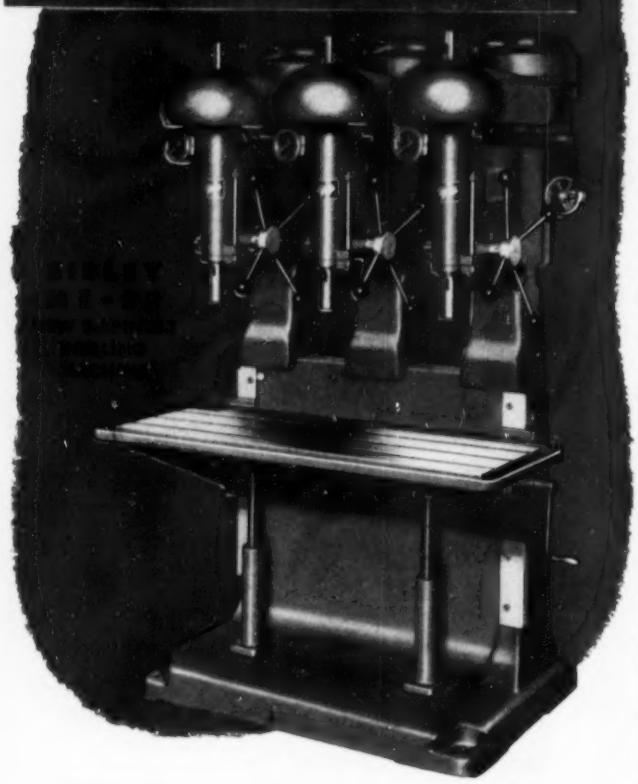
Cut Work Handling



Work-handling consumes more time than work-cutting in producing many jobs. Reducing manual effort by one-half may increase production more than by faster cutting speeds. To make this improvement without burdening the operator —in fact to make it easier for him—is the chief advantage of the new Sibley Model ME-25.

The variable speed drive, the big 21½" swing, the extra large table, the convenient speed controls, the handy tachometers, all combine to make this 1" capacity, medium weight machine a production advantage in any shop!

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ities and reasoning so that there will be developed an unfoldment or an acquisition of a harmony, a little at a time; further, it can be gradually unfolded just as certainly as the laying of brick upon brick may rear a palace.

Today, we interpret the word "business" in the larger sense to cover all of the activities and relations of one man or a group of them with other men, and consider all men as businessmen whether they be millionaires or men in the shop.

No matter in what particular station in life a man may be located at any one time, each is a worker in the world of action and wealth, and each seeks to be a leader.

The element of leadership is stronger in some than in others and this marks the difference in capabilities.

Leadership may be said to be a qality of mind; one who has it feels mentally superior in his makeup and accordingly applies himself dynamically in his field of endeavor until he forms a habit of doing superior work. He usually rises in the business and social world above many other people. This may become more marked during each successive year.

One of the secrets of leadership is to hang on after others have become discouraged and left off; at the same time, some of them will admit their failures.

It has been said that the highest human science is the science of practical individual culture. Al holds the position of a leader and a foreman, but he should ever be willing to consider the men who work with him. Some of them may have leader qualifications and may have ideas which are good for the firm, good for Al, and also for the men themselves.

"It's a little recording of what I would say if I told the boss off—I play it sometimes when I'm discouraged."

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2. BACK-TO-BACK
3. DUST-TIGHT
4. WEATHER-PROOF
5. FILTERED AIR

1 Standard Square D Plug-in Control Centers in Nema I enclosures are designed for the majority of installations.

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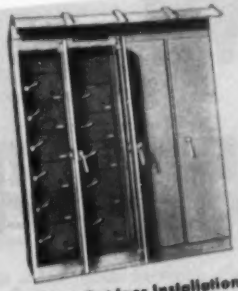
Write for Bulletin 8938. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

2 Space an Important Factor? Back-to-back Nema I enclosures provide maximum concentration of control in limited space.

3 for Excessively Dusty Locations—belt-gasketed, dust-tight, Nema V enclosure. A "natural" for foundries, smelting and refining plants.



4 for Outdoor Installations—rubber-gasketed, Nema III enclosure protects equipment from weather. Special rust-proof, vinyl-clad finish.

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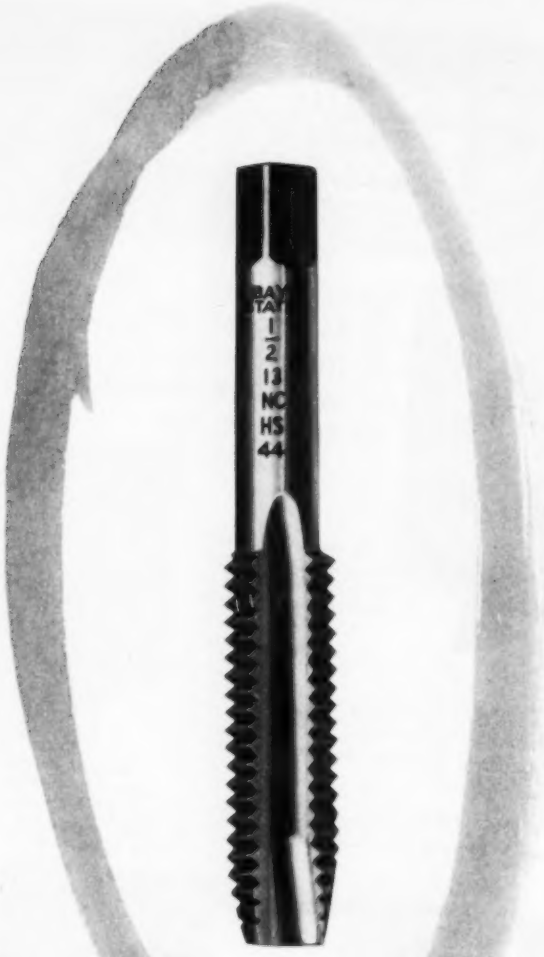

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Legitimate criticism of a constructive type is always good. Perhaps Morton's action did confuse Al, but it may have done him good because it probably awoke him up to a point where he could analyze himself and so realize some of his weak tendencies.

Again, it is the belief of the writer that Al should have another discussion with Morton, and, while doing so, try to iron out their differences. This would give Morton a chance to go into his reasons for his conduct and allow him to cool off and talk over their troubles in a reasonable manner.

During the old days, a foreman would have fired Morton on the spot and would not have taken the time nor opportunity to learn what was behind his actions.

The other men in Al's department, due to the fact that this quarrel took place in Al's office, may know nothing about it and apparently, Morton will not disclose anything in regard to it.

Neither man will pay too dearly for this experience, but, in paying it off, both men should be wiser and more tolerant.

Tolerance or patience, many times, are developed very gradually and so they take the places of less-agreeable talents. As Mark Twain once wrote, "Habit is habit and is not to be thrown out of the window by any man but must be coaxed downstairs a step at a time." By both of them using an agreeable slant on life, they should come to an understanding and then part as good friends.

If Al does not have this talent to meet this emergency, he should not be a foreman.

F H Stebbins
Worcester, NY

•

A FOREMAN of the Al type cannot afford to take anything in the nature of what Morton told him. Ed says Morton is a man of sound judgment and is level-headed. Therefore, what he told Al probably was the truth; maybe that is what all the men in the shop think, but dare not say.

Although he holds the position of foreman, Al does not figure as a leader nor as a fore, or front man. Can one imagine Al bawling Morton out; it would be like a mouse roaring at a lion, resulting, in effect, in a feeble squeak.

There would appear to be a more serious side to the question. The foreman is a part of the production force; if he be a leader and knows his job, it could be expected that the

shop output would be good both in quality and quantity. If, however, the capacity of an Al were symbolized, he would appear as a dwarf and his influence would be small accordingly.

To give the illustration a production touch, it could be not unlike trying to drive a 1000-hp works with a 750-hp prime mover.

No, the Al's cannot blow off or bawl a man out effectively.

The crucial point would seem to be not so much what a foreman ought or is prepared to stand from a man working under him, but how long a company should allow a man to retain his office after he has demonstrated his unfitness for it by his inability to control.

P E James
Lincoln, England

•

IN ALL SHOPS, a certain standard of mental hygiene, as well as discipline, must be upheld. Therefore, I cannot go along with Morton's calling Al a jackass. I don't blame Al for getting a shock at such an approach. If Morton called me a jackass, I would have fired him immediately. And with what right does Morton accuse his foreman of amateurism and contradiction? This is none of his business.

Morton is not a level-headed cuss, nor does he have good judgment when he commits such an offence as the above. If he did have good judgment, he would have approached Al in an entirely different spirit, and with more positive arguments.

It's true that any foreman is open to all sorts of criticism, and he might have to stand a good deal. Morton's kind of criticism, however, doesn't rock anybody to his heels, but is apt to arouse his anger. And an angry

"I had hoped my son would grow up and come into partnership with me, but the government beat me to him!"

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foreman who is sure of his rights might be dangerous, especially for men like Morton.

No foreman need take abuse like this lying down. If he does, his boys will look upon him as being sissy, and lose all respect for him. Morton should be glad if the only result of his offence is a bawling out. If he had shown an attitude of cooperation, and pointed out things that Al had overlooked, his criticism might have done some good. If Al does nothing about the matter, Morton will repeat his abuse, and make conditions unbearable.

A foreman's men have no right to judge him at all; this is a matter for the management. If Al is incompetent in his job, Morton could have approached the superintendent in a fair way, and not used methods better suited for gangsters or other law-breaking individuals.

A E Fristedt
Stockholm-Bromma, Sweden

•

MERIT INVENTORY

Is a merit inventory worth the trouble involved to maintain it? Or is the trouble minor compared to the advantages of having a handy, overall record of a worker for reference purposes? Opinions vary . . .

MERIT RATING is perhaps one of the most important tools which is available to modern industry and to its supervisors. Long hours of effort have gone into the study of merit-rating forms. The basic information which each type of form has on it is the same in principle, but varies in degree of simplicity. This is not so important as the fact that the basic principle is the same. Each form is striving to get the foreman or supervisor to think about his workers. Each form is trying to get an analysis of the qualities of the individual. Not to record such information in detail, but when time is involved, to check off qualifications as listed on the form.

Many supervisors have felt much as Ed feels—that a lot of time is required to do this work. Yet when they start the system and if they are good foremen, they never want to operate without it. It does tell them the progress of their workers. They find that checking merit-rating sheets, when transfers or lay-offs are necessary, is a time-saver for them and a money-saver for the company. Many qualities called for in checking the form are frequently overlooked in the daily hustle of getting out production. Merit rating records

the smith had the right idea

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INQUIRIES PROMPTLY ANSWERED

these for a future date. People also change. They improve, or they deteriorate, or grow stale. The persons who grow stale cost the company money and should be transferred to some other operation of the plant or if necessary, dismissed.

Under the pressure of high wages and increasing competition the cost of labor becomes a very serious point in the manufacturing cost of the product. Thus to have many drones in the hive of industry is to drive a company into bankruptcy. In order that a little clearer picture of just what is being accomplished and just what each of these items which are rated means, we should study one of the forms.

Let us briefly jot down what each item means—for, once this is clearly understood, it is possible to place an employee in the proper niche by determining to what degree he is a proper employee . . . as interpreted by the foreman's thinking on the merit-rating form.

The form I have found most suitable for all general work includes rating on the following aspects:

PERSONAL HABITS—Is the employee pleasant and courteous or is he overbearing, profane and loudmouthed? Is he in regular attendance at work, and makes requests for time off infrequently?

LEADERSHIP ABILITY—Do fellow workers like him and naturally follow him? Do others tend to seek his advice and opinions—not only about the job but also in general? Does he take the lead when working with others as a team? Is he ready and willing to accept any responsibility?

CONDUCT—General observance of working rules and regulations. What is the worker's conduct outside the plant insofar as it affects his job and position with the company?

TEAMWORK—Is the employee doing his share of the work, and a little more, or is he always lagging behind the other members of his team, Do men and women like to work with

"Fork goes on the left, ya know!"

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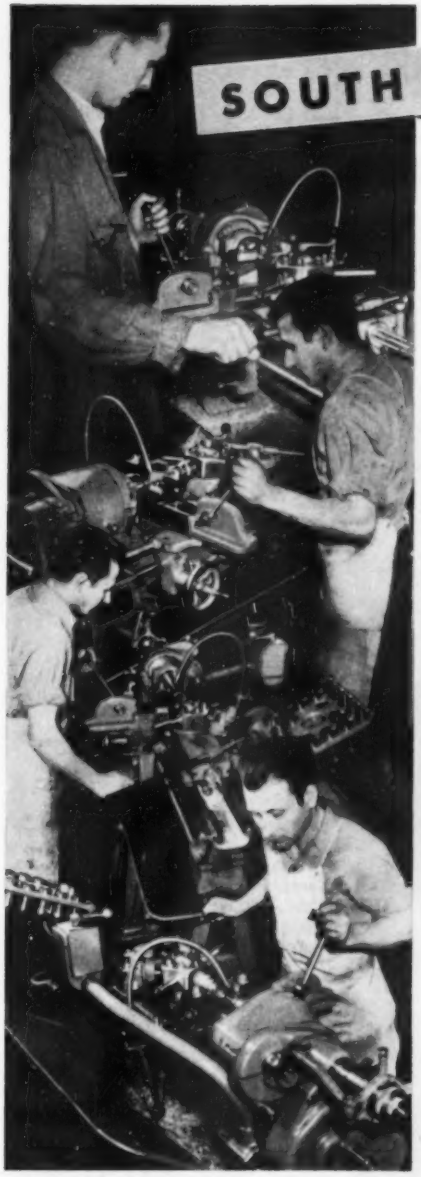
STANDARD OR SPECIAL, FOR EVERY MACHINE TOOL AND INDUSTRIAL USE

Rollway PUMPS

Pioneer PUMP & MANUFACTURING CO., INC.

19651 JOHN R STREET
DETROIT 3, MICHIGAN

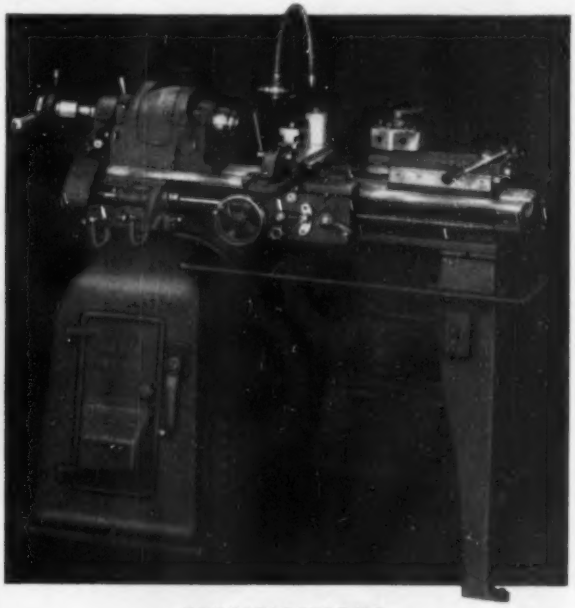
WRITE FOR CATALOG



SOUTH BEND 1000 TURRET LATHE

Cost-Cutting Versatility

This precision turret lathe will cut your machining costs on small parts. Built-in accuracy, ease of operation and a wide range of speeds and feeds insure high production and close tolerances. Practical attachments simplify tooling the lathe for jobs which might otherwise require special fixtures. What's more, your least experienced operator will soon be a top producer on the 1000 Turret Lathe — it's that easy to run. Find out how this versatile turret lathe can improve your machining — *send coupon now.*



SPECIFICATIONS

Swing	10-1/8"
Turret to Spindle	19-3/8"
Collet Capacity	1"
Spindle Bore	1-3/8"
Spindle Speeds	12
	50 to 1357 r.p.m.
Power Longitudinal Feeds	48
	.0015" to .0836"
Power Cross Feeds	48
	.0006" to .0309"
Thread Cutting Feeds	48
	4 to 224 per inch

AIR NATIONAL GUARD · PROTECTS AMERICA ·

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

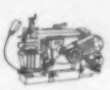
Send Information Checked:

☐ _____ ☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ ½" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES



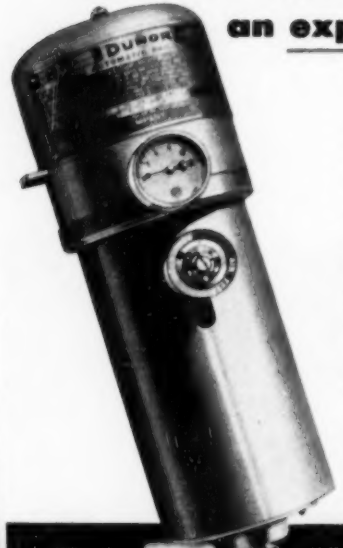
☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

NOW, DUMORE DRILL HEAD

makes every drill operator an expert!

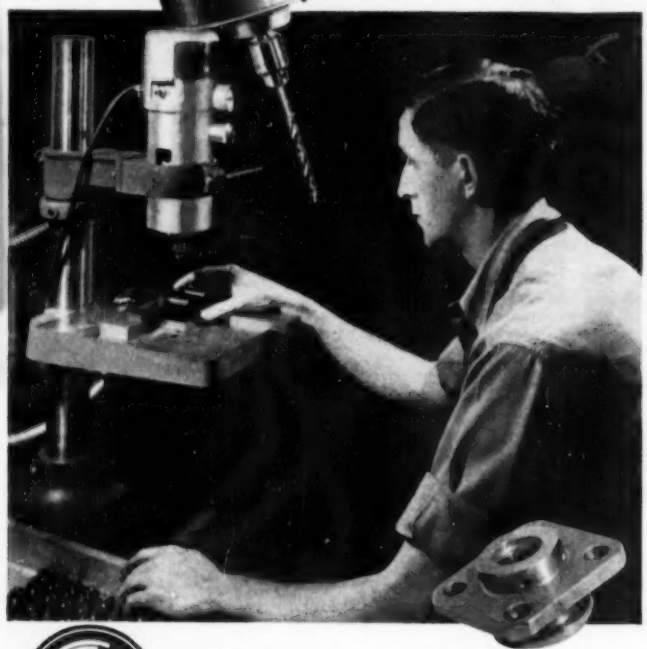


THE new Dumore Automatic Drill Head does away with operator guesswork — the new *resistance drilling* way. *High drill breakage losses are virtually eliminated by this remarkable new tool.* It produces premium quality, small diameter deep holes, even with unskilled labor. And shop foremen report average drill life increases as much as 93 per cent.

Dumore's new *resistance drilling* automatically equalizes the *exact* pressure required for every stroke of the drill head . . . automatically compensates for variations in drill quality and workpiece hardness . . . factors your drill operators can't compensate for by sense of touch alone.

Depend on Dumore Automatic Drill Heads — *and get big savings in drill costs,* quality workmanship plus production increases.

Get all of the advantages of this remarkable shop tool. Ask your nearby industrial distributor for a demonstration, or write the Dumore Company.



Holes for airplane parts are produced 12 times faster at a 97% cost reduction with this setup. In fact, the Dumore Drill Head paid for itself after only 4½ hours operation.

THE DUMORE COMPANY

1337 Seventeenth Street • Racine, Wisconsin

him? Does he co-operate with you and with his fellow workers? Does he think about others or does he just think about himself?

RELIABILITY—Are you able to depend upon the worker? Can you give him a job to do and know that it will be done right, and to the best of his ability?

AMBITION AND INITIATIVE — Under ambition—is the desire to get ahead and to improve himself apparent? Is he working for a better job? Under initiative: Is he constantly trying to figure new ways to do his job better? Does he make suggestions? Does he study and try to prepare himself for a better job?

ABILITY TO LEARN — Is the employee able to catch on rapidly? Or does it take him a long time to see through his work? Does he retain what he is told or is it necessary to constantly remind him?

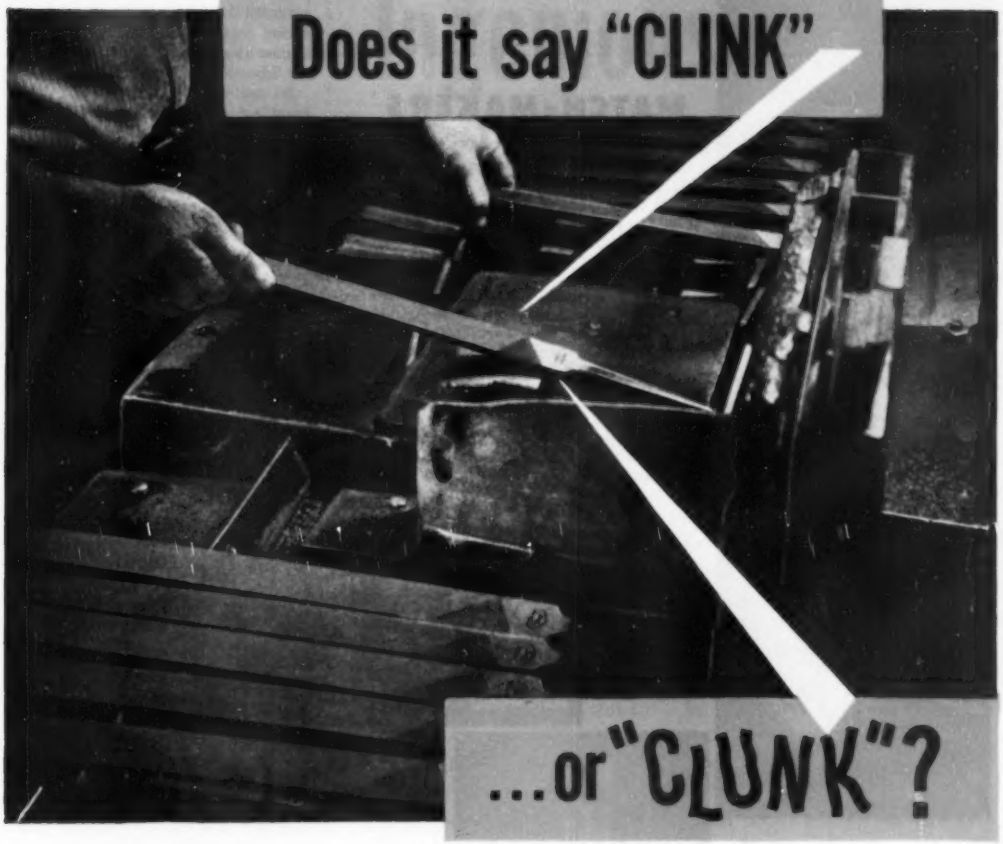
ATTITUDE TOWARD WORK — Is every effort being made to co-operate? Does he do the little things on his own initiative or is it necessary to tell him each move to make? Does he want to do a good job and is he willing to learn to do it? Does he accept temporary assignments to disagreeable jobs without unnecessary griping?

QUALITY OF WORK, SPEED, ACCURACY — In general, this covers the actual job performance. Does the employee turn out a good quality of work? How much does he do? Does he abuse the tools and equipment or does he take care of them? A good combination of an average individual would be an employee who turns out the average quantity of work of good quality in the average length of time.

ABILITY TO DO ASSIGNED WORK—In rating this item remember it refers to the quantity and quality of the work the employee is ca-

"I like Ike myself,—but let's not get carried away with our political convictions."

Does it say "CLINK"



...or "CLUNK"?

ONE of the proofs of a file's basic soundness is its clear ring — "clink" — when you tap it lightly on an anvil or other hard piece of metal. A dull "clunk" is usually a sign of "water cracks" or poor hardening.

Nicholson employs a score of checks and tests in connection with steel examination, forging, blank smoothing, annealing, cutting, hardening and other operations in the manufacture of files. The "ringing" test is one of many that lead to the final "okay" under the Nicholson policy of *Twelve perfect files in every dozen.*

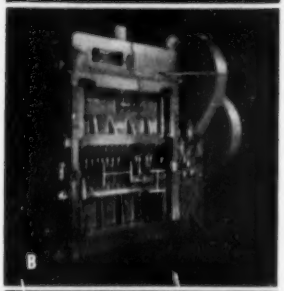
This company really "leans over backwards" to put into Nicholson and Black Diamond files longer sharpness, better performance, greater value than are combined in any other commonly known brand. That's why it pays to specify them . . . and why industrial distributors are proud to recommend them.

BUY THROUGH YOUR INDUSTRIAL DISTRIBUTOR

FREE BOOK, *"FILE FILOSOPHY"* — 48 interesting illustrated pages on kinds, use and care of files. Indispensable to production heads, purchasing agents, shop foremen. How many copies shall we send you?

NICHOLSON U.S.A. **NICHOLSON FILE CO. • 29 ACORN STREET • PROVIDENCE 1, RHODE ISLAND**
(In Canada, Port Hope, Ont.)
BLACK DIAMOND TRADE MARK

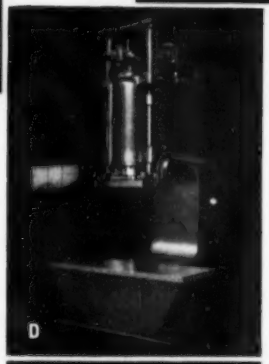
NICHOLSON FILES *FOR EVERY PURPOSE*

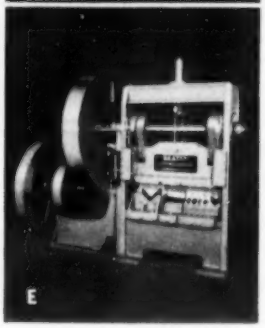


MATCH-MAKERS

BEATTY specializes in making machines to match various heavy metal working conditions and problems. If one of the machines shown can't be modified to suit your needs, we'll design and build one that does. Broad experience in varied metal working fields has taught us that there is always a better way to solve production problems. Let one of our engineers show you how the BEATTY way is a BETTER way to increased production and economy.

BEATTY
MACHINE & MFG. CO.
HAMMOND • INDIANA





A. BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging and bending.

B. BEATTY Guillotine Beam Punch. Punches webs and flanges in "I" beams from 6 to 30 inches.

C. BEATTY Spacing Table handles web and flange punching without roll adjustment.

D. BEATTY Gap Type Press for forming, bending, flanging, pressing. Capacity 250 tons.

E. BEATTY Guillotine Bar Shear for angles, bars, rounds, squares without changing tools.

pable of doing rather than what he actually does. In nearly all cases the rating on this item must equal or be higher than that given under Quality, Speed and Accuracy.

So we see that by studying and knowing what each heading really means, the job of rating is not at all complex. Neither is it a big job that requires hours of determination. Once it is accomplished, a picture of the employee is before you. Comparisons can be made between individuals. Employees can be strengthened by pointing out their weaknesses. Thus better relationships and more productivity can be gained.

Charles D Townsend

•

BACK IN 1924 while working as a toolmaker, the works manager called me into his office and told me I was now a foreman. I liked my job as toolmaker, and inquired why I was chosen over others with longer service. He replied that I knew more about the machines, production and quality.

Machine or engineering problems didn't bother me—I could handle them—but people did.

One of the first things I learned was that I could not fire a man with a poor attendance record because someone else in the department had an equally bad record. If I fired one, I would have to fire both. When an employee came to me for a raise, I didn't know how to give him one. I was in a fog because I didn't know the paper work or the system.

It became quite apparent that I would have to learn more about people. Many times I was forced to say, "I don't know, but I'll find out."

"Somebody here with a complaint—?"

With the realization that the human aspect of the job was the biggest single factor, I started a merit inventory. It included production, quality, attendance, responsibility, loyalty, attitude, adaptability, etc. It was not long before I had a good picture of every man in the department, including myself.

My weak point was the fundamental good principles of human relations. When I corrected this fault, I began praising the employees' good qualities. I found that calling attention to merits takes the sting out of correction of faults.

This merit inventory helped me keep grievances at my level which would otherwise have gone up front.

A E Salmons
Philadelphia, Pa

•

THE PSYCHOLOGICAL effect of merit-rating forms is worth all the effort put forth in maintaining them. These forms are nothing more than a record of comparison between workers which the mind of the foreman is incapable of keeping track of over a long period of time. They serve as a convenient record to be called upon at various times during the employment of the worker, as well as an accurate account of achievement or adverse characteristics necessary in making an accurate appraisal of a man's worth when called upon for information pertaining to him by a prospective employer.

No two men are made alike, nor do they act alike under similar situations. Some are skilled in different phases of the work, in different degrees; some possess varying characteristics which are of equal value or better than usual skill.

Personally, I would rather have a man under me who was cooperative, sincere, and eager to please than one who was exceptionally skilful and whose loyalty was in question. Fortunately we do not have many of the latter to contend with.

The man who performs his work to the best of his ability and does not shirk his responsibilities deserves a mark of recognition. How often will one find a worker who is willing at all times to do a job assigned to him regardless of whether the job is a dirty one or not. A foreman who is on the up-and-up will not take advantage of such a worker although there are untold numbers who are inclined to push a good thing too far. There is no advantage in wrecking a man's spirit by shoving his nose in the dirt.

Ingenious Ways of Getting Steel

Steel continues in short supply from causes well known to all.

However, business must go on, and our customers, with the close cooperation of Ryerson engineers and metallurgists, are performing near miracles in order to keep the wheels of industry turning.

Leaner alloys are being heat treated and used where it was never believed they could possibly serve. Available chrome stainless is doing some jobs better than the restricted nickel chrome formerly used.

When large rounds are not in stock we are furnishing forgings, which are stronger and quite satisfactory.

Hot rolled bars are being machined when cold rolled bars are unavailable, and cold rolled bars are being used where only hot rolled bars were used before.

Heavier and larger welded tubing is replacing hard-to-get seamless, and available square welded tubing is being used in structural applications formerly requiring angles, channels or beams.

To meet one customer's rush order for 18" plate circles, we secured the left-over center pieces from a second customer who was cutting 20" plate rings. And on another recent occasion we furnished T's not otherwise available by splitting a number of I beams.

On other products we are asking for the exact size and length needed so we can fill orders from shorts even though we're not able to furnish the steel from our regular stocks.

In addition we have operated a steel and machinery exchange in the Ryerson Pictorial to expand the available supply and now are receiving lists of material from customers and passing them on to others through our sales representatives.

These are only a few of the many ways in which we are helping steel users meet their requirements.

Obviously, we are not always able to come through, but we invite you to call on Ryerson experience and facilities when you need steel. We will always do our best and sometimes the results may surprise you.

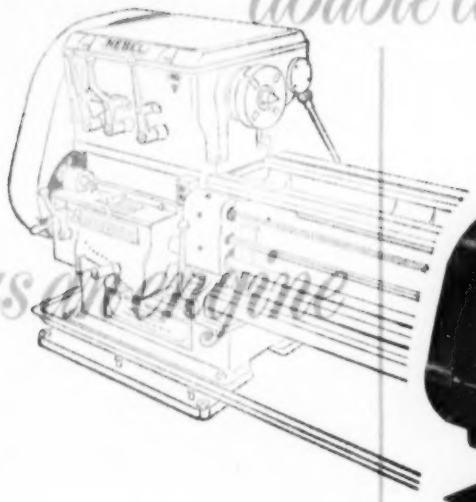
PRINCIPAL PRODUCTS: CARBON, ALLOY & STAINLESS STEELS . . . BARS, STRUCTURALS, PLATES, SHEETS, TUBING, ETC.

RYERSON STEEL

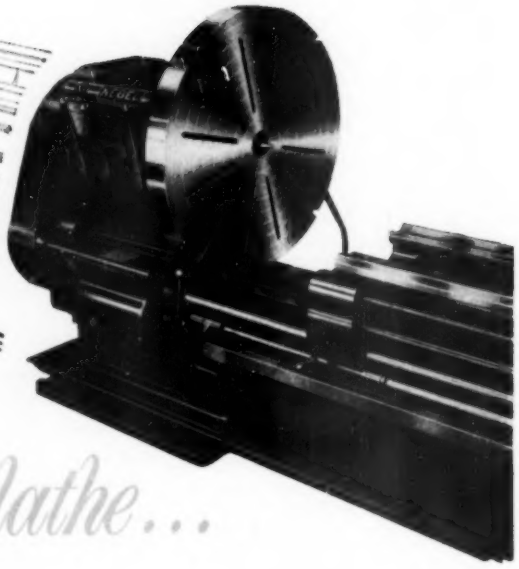
JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA CINCINNATI • CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Nebel

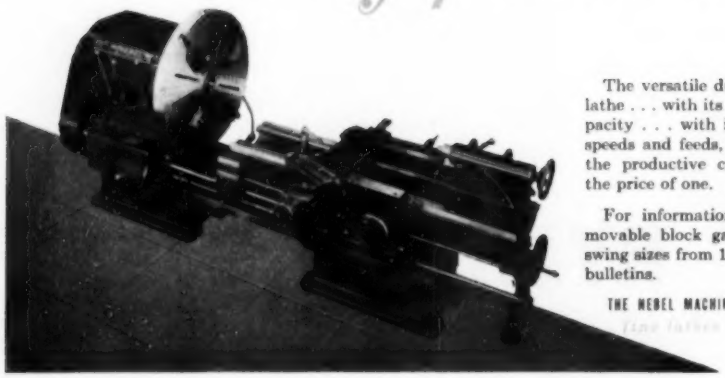
double duty gap lathes



as an engine



or a gap lathe . . .



The versatile dual purpose Nebel extension bed gap lathe . . . with its flexible swing and center distance capacity . . . with its tremendous power, wide range of speeds and feeds, and Nebel-built accuracy . . . offers the productive capacity of two ordinary lathes for the price of one.

For information on Nebel extension bed gap, removable block gap and heavy duty engine lathes, in swing sizes from 18″ to 50″, write today for descriptive bulletins.

THE NEBEL MACHINE TOOL CO., CINCINNATI 25, OHIO

The merit-rating system enables the manufacturers to establish universal understanding between them. It engenders cooperation and prevents annoying incidents such as labor pilfering and withholding information of benefit to both parties. The Personnel Department is unable to keep track of the various merits and demerits of the individual employee, and should be governed by the department foreman's opinion. Obviously there should be no unfair discrimination, as often happens when misguided foremen allow their personal prejudices to override their sound judgment.

Machinery should likewise be covered by merit-rating records so as to enable one to accurately appraise their respective values when the time comes to purchase new equipment.

While rating the merit of the individual, I would like to see an accurate account kept of his educational initiative. There should be a record of a man's effort to improve his technological knowledge pertaining to the class of work he is doing. One may be an exceptionally skilled worker who is satisfied with conditions and who makes no effort whatsoever to improve himself in advanced practices. He usually is a happy individual and rarely starts any trouble. Compare him with the equally skillful worker who spends many hours of his free time studying up on math and science. Obviously this fellow is worth recording with favorable comments; he will be ready for advancement when the need arises.

No foreman is a superman and able to keep records in mind of the merits of the different individuals in his

"It's a sample heat-treating furnace the salesman left . . . it's great for grilling hamburgers!"

Right you are, friend diver, regardless of the method of abrasive cutting you use — or the material you're cutting — there's an Allison Abrasive Wheel that will do the job more efficiently, more economically. Whether it's steel, glass, non-ferrous metals, ceramics . . . tubing, shapes or bar stock . . . Allison Wheels cut at high speeds, cleanly to a few thousandths.

For complete data on both wet and dry cutting . . . information on abrasive machines . . . recommendations for the selection of the *right* Allison Wheel for your job, send coupon for a copy of the NEW Allison Catalog. You'll find it a *treasure chest* of valuable information.

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ABRASIVE CUTTING WHEELS

THE TOUGHER THE CUTTING JOB . . . THE BETTER THE OPPORTUNITY FOR

abrasive cutting

THE ALLISON COMPANY
256 Island Brook Ave., Bridgeport 8, Conn.

Gentlemen: Please send me a copy of your new catalog.

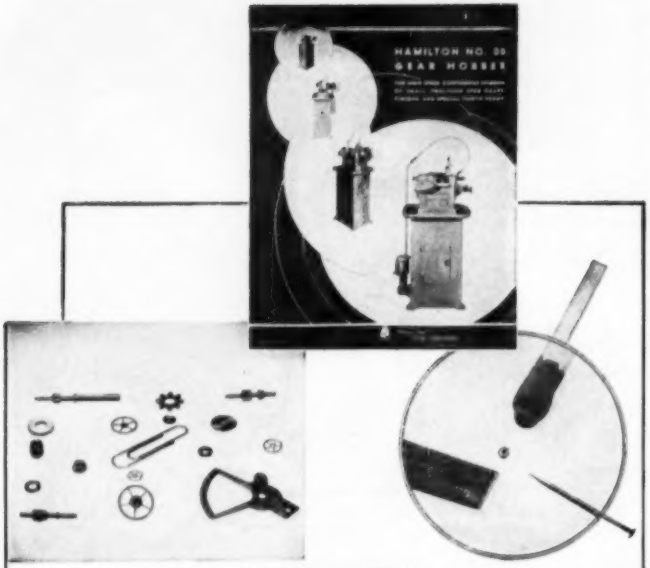
*Name*_____

*Company*_____

*St. & No.*_____

*City*_____ *State*_____

2ALS2



THE MOST NEWS
and
THE BEST NEWS

ABOUT SMALL, PRECISION SPUR GEAR HOBBING

IS YOURS
FOR A MINUTE AND A PENNY

Does your job involve small, precision spur gears? Would you like to produce them fast?

Whether your work calls for long production runs or frequent set-ups, you need to know about the Hamilton No. 00 Precision Spur Gear Hobber. Spend a minute now to send your request for a copy of our Bulletin No. H-00-49. Acquaint yourself with this efficient tool, and be ready for the challenge ahead.

NOTE: If you are interested in helical gears, worm gears, bevel gears, and crown gears, as well as spur gears, ask for Bulletin H 1-49. No obligation.

THE Hamilton TOOL COMPANY
830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

department. He may be able to make a pretty good appraisal of a man's worth but he is likely to forget some good points that are of inestimable value. Notations should be made while fresh in mind and not left to the frailties of capricious memory.

I would advise a daily recording in order that the record be strictly up to date. How about leaving the daily ratings exposed so as to be available to the employees in the event they desire to look them over. This, and a self-rating card filled out periodically, will be influential in keeping a man on his toes. I would provide a special column for grumblers, wanton carelessness, and troublemakers. Those committing offenses detrimental to the welfare of the whole crew I would mark up in red. I would like to see the super-double X-er given proper recognition, not only on his card, but in that glittering folding stuff that speaks volumes.

John Homewood
Ontario, Calif.

•

IF THE POOR, bewildered foreman, who usually is far underpaid when one considers the troubles heaped on his shoulders by the highly-paid men under him, is going to spend all his valuable time on red tape, such as recording items of merit, demerits, and whatnot, when is he going to have any time for supervision, fatherly counsel, justifiable reprimands, and the thousand and one other duties commonly understood to be within the category of executive control?

As for me, I have always had an aversion to such things as statistics and records forced upon me by higher-ups in order to satisfy their unbalanced whims. They seem to be

"Being in charge of the fork-truck fleet don't give you the rank of admiral."

for fast assembly...

Torrington Needle Bearings are "naturals" for fast assembly line operations. Here's why:

They are complete, compact units, ready for instant installation.

No time is wasted producing complex housings—a straight bore, machined to size, is all that's needed.

A simple arbor press operation seats Needle Bearings by press fit—no spacers or retainers are required.

The high radial load capacity, compact size, light weight and other advantages of Needle Bearings help improve product efficiency. Why not get the whole story from your Torrington engineer today?

THE TORRINGTON COMPANY
Torrington, Conn. South Bend 21, Ind.
District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON *NEEDLE* BEARINGS

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

In one operation, this Farquhar Hydraulic Press forms straight mild steel bars into elevator brackets—at closer tolerances than any former method.

OTIS ELEVATOR COMPANY *boosts production, slashes time and labor costs in half, with this*

FARQUHAR HYDRAULIC PRESS

In forming lengths of mild steel, the Otis Elevator Company, world's largest elevator and escalator manufacturer, would heat steel and bend it while it was hot. Trying to improve on this system, Otis Production Engineers developed a cold bending process. Farquhar Engineers were contacted, and a 250 Ton "Bulldozer" Horizontal Press was recommended and installed. By bending the steel bars cold in the Bulldozer, Otis has effected a 50% increase in production alone! Time and labor costs have been reduced an estimated 33⅓%! In addition, the Bulldozer operates at closer tolerances than the old heat and bend method. All this, 8 hours a day, 5 days a week, with maintenance costs that Otis terms "negligible."

Farquhar Presses Cut Your Costs

Just one more example of cost-cutting Farquhar performance in heavy production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve whatever production problem you may have. Your request will bring them running . . . at no obligation, of course.

Send for free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industries. Write to: A. B. FARQUHAR CO., Hydraulic Press Department, 1506 Duke St., York, Pa.

Farquhar
HYDRAULIC PRESSES
A. B. FARQUHAR COMPANY Division of THE OLIVER CORPORATION

something concocted by certain screwball types of individuals who have nothing else to do but think up unnecessary things for busy people to worry about.

If a foreman can't keep track of his men in his own mind without taking up his valuable time to make records that are usually shoved in a file and left there to rot, there's something decidedly weak about his status as a foreman. What in the name of heaven is a foreman's head for?

My memory, which isn't considered to be a super-product of creation, will be able to record subconsciously any variation from the monotonous usual.

Bear with me for a moment and cast your blinkers, if you will, on the eminent Claudious Moferdite, a worker who has risen in the ranks from a grease monkey to a first-class toolmaker, and, through dint of the spirit of free enterprise becomes a valuable asset to his employer. He jumps in with that exhilarating springtime zest whenever he gets an assignment and sails through his work to its satisfactory completion. Claudious knows his stuff and he knows what's expected of him. He is a bother to no one—especially to me—and you can put your two bucks on the line that when he hands in a job, it is done right. Why should I go to the trouble of sticking a gold star in column nineteen for the guy when I know what he can and does do? Do you suppose that I will forget the merits of the man? No, siree, I won't. When Claudious is ready to pull out for a change of scenery I won't forget what an unusual worker he is and I'll not hesitate to tell the inquirer so.

"Moon out of round?"

FIVE FACTORS THAT MAKE

UNIVERSAL SUPER FINISHED

DRILL BUSHINGS THE FAVORITE

IN AMERICA'S LEADING

PRODUCTION PLANTS

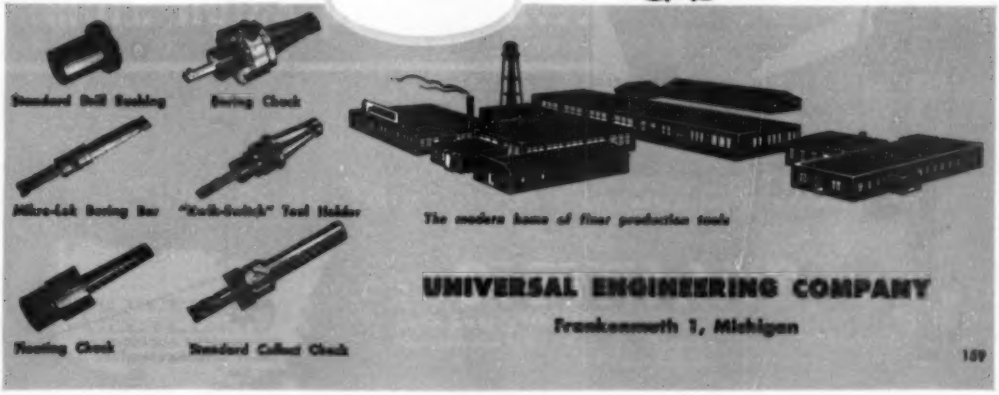
1 super finish reduces wear to a minimum

2 blended radius reduces tool hang up

3 100% concentricity and hardness tests assure accuracy

4 knurled head provides quick sure grip

5 complete variety of sizes and lengths

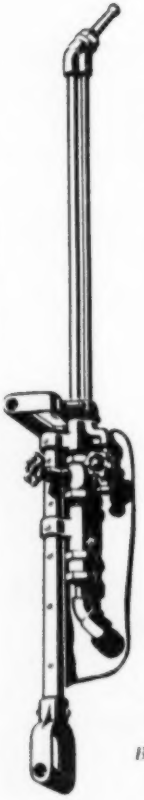


UNIVERSAL ENGINEERING COMPANY

Frankenmuth 1, Michigan

189

HOW DO YOU CLEAN BIG METAL PARTS?
HOW DO YOU STRIP PAINT OFF THOSE LARGE STEEL SHEETS?
HOW DO YOU KEEP YOUR EQUIPMENT SO CLEAN?
I USE AN OAKITE STEAM GUN FOR ALL THE HARD JOBS. IT SAVES TIME AND MONEY



This happy man has found the answer to all the tough cleaning problems.

He knows the best way to clean metal parts that are too large to be soaked in tanks or conveyed through washing machines.

He knows the best way to strip paint from large parts and large surfaces that can't be soaked.

He knows the best way to clean large equipment such as:

- die casting machines
- wire drawing machines
- blooming mill rollers and cutters
- hoisting machinery
- brass reduction machines
- millers and grinders
- buffing machines
- forge hammer parts
- drill presses
- stamping machines
- motors

He knows his Oakite Steam Gun will do practically every cleaning job that's too big or too difficult to do by ordinary methods.

FREE For your copy of "*Time saved with Oakite steam-detergent cleaning*" write to Oakite Products, Inc., 34E Rector St., New York 6, N. Y.

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SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE

National Metal Exposition

Technical Service Representatives in Principal Cities of U. S. & Canada

Let's go on with another of these few unusuals. Take Harry Outsides, the fellow who came to me highly recommended by a friend of his. Harry worries the hell out of me unnecessarily by petty details every time he gets a job to do. Do you think I will find it necessary to refer to any card in the records to remind me of what a headache he has been? I'll tell the world I won't, and you can depend on it that anybody who contemplates hiring him will get an earful straight from me.

Then there's the fellow who couldn't live without his pick-me-up anytime he sees something that looks like a bottle. He plugs along and turns out his work without any if's and and's but is continually surrounded with an aura of hootch. Believe me I'd get cramps in my right hand if I had to record items of unusual behaviour opposite his name. The fact that he does very accurate work is puzzling when one knows that he has to carry a little stool with him so that he can maintain his proper balance.

I could go on and on dwelling on these industrial misfits who stand out as glittering lights in the constellation of red-letter workers worthy of kindly words and sulphuric sprinklings in times of necessity. Why make records of these unusuals? Give the foreman a chance to develop his own virtues by letting him exercise the talents given to him.

Jack Everett
San Francisco, Calif

•

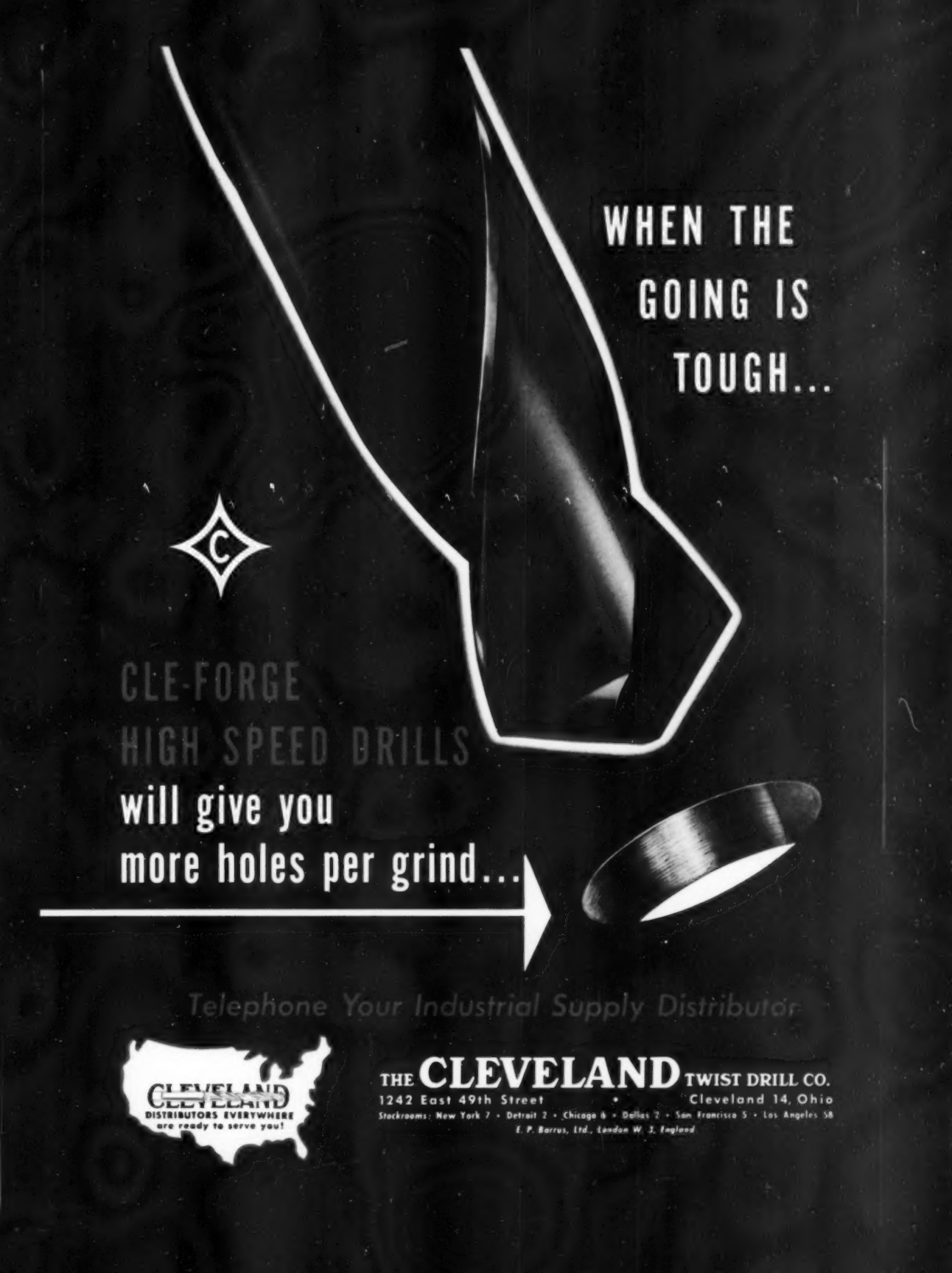
AGAIN ED shows himself to be far behind the times.

The oldtime shop, or the people in it, looked upon most anything in the way of records which indicated how a man stood in his department as being ridiculous.

The only records which were kept

(*Continued on page* 268)

"This tool is three days overdue . . . you owe six cents fine."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HIGH SPEED DRILLS
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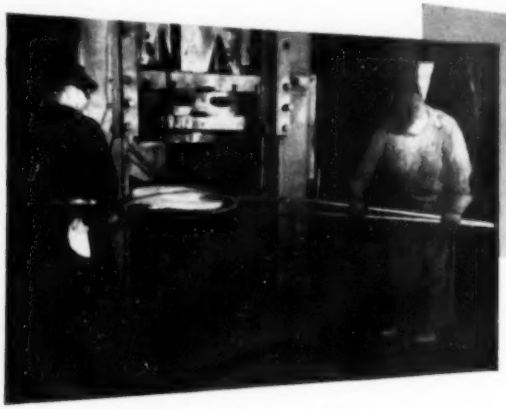
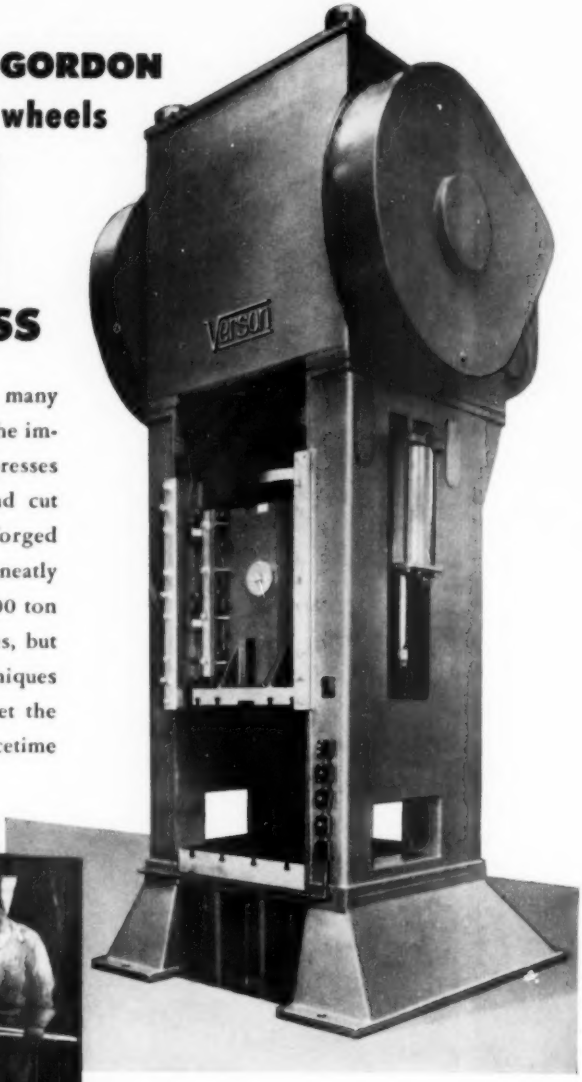
Here's How WYMAN-GORDON trims jet engine turbine wheels with a 600 ton Verson CRANK TYPE PRESS

At Wyman-Gordon Company, as in many plants engaged in the production of the implements of defense, modern Verson presses are helping to speed production and cut costs. Take the job illustrated below—forged jet engine turbine wheels are trimmed neatly and quickly in a single stroke of a 600 ton Verson crank type press. Routine, yes, but it is the sum of such production techniques as this that enable our plants to meet the demands of a part war—part peacetime economy.





Illustrated above is the 600 ton Verson single crank, single action, double gear twin drive press. Bolster area, F.B. x R.L., is 56" x 48". At left the piece being removed from the press after trimming.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

ALLSTEEL PRESS COMPANY

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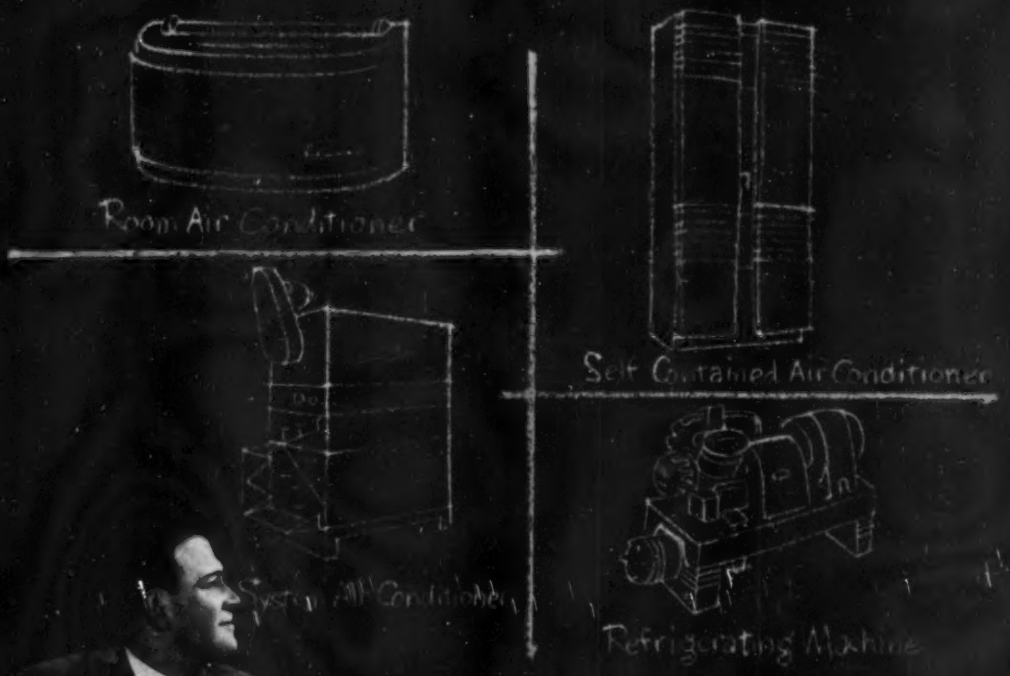

Room Air Conditioner
Self Contained Air Conditioner
Refrigerating Machine
Some manufacturers make and sell one of these products and are in other kinds of business. Carrier makes all of them and specializes in air conditioning

Why does this give you better air conditioning?

The business of air conditioning is more than just manufacturing. You get the best results only when the proper equipment is applied to your particular need.

Carrier makes every kind of air conditioning equipment — more kinds than anyone else in the industry.

Therefore, when you deal with Carrier you have available the widest range of equipment that is made. You can get whatever it takes to solve your particular problem.

We have no ax to grind. We make every kind of air conditioning, and this means that we can be completely objective.

You are entitled to the best in air conditioning. To get it, see your Carrier dealer. In your community, he's the man who knows air conditioning best. He's listed in your Classified Telephone Directory.

Carrier **air conditioning • refrigeration**

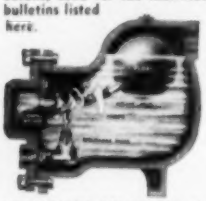
for 50 years—the people who know air conditioning best!

Send for Nicholson Bulletins on These

3 WAYS TO SAVE TIME

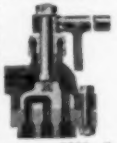
in Production and Maintenance

On the basis of their time-saving records, leading shops are increasingly standardizing on these 3 Nicholson units. For details, send for the individual bulletins listed here.



NICHOLSON AIR TRAPS—For intercoolers, aftercoolers, receivers, tanks, etc. Feature non-plug and non-wire-drawing valve. Instantaneous operation and extra large drainage capacity effect fast, positive action. Catalog 751.

NICHOLSON CONTROL VALVES — Specially treated hard seats, wide choice of metals for specific mediums, and easy repacking cut maintenance time. Non-corrosive flat discs lap themselves on seats. Many leading plants have adopted Nicholson valves because of their longer leak-free service. 2-, 3-, 4-way and special types. All manner of operation. Size ¼" to 2½"; press. to 5000 lbs. Catalog 552.



NICHOLSON EXPANDING MANDRELS—Set of 14 does work of 209 solid arbors; sensational time savers in some operations. Sold singly or in sets; for bores ½" to 7". The standard in shops the nation over. Bulletin 750.

114 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Quality Craftsmanship

Since 1907—for 45 years—The Cincinnati Gear Company has been producing **Gears—Good Gears Only.** Expert, efficient craftsmen, working with top quality materials, have built for The Cincinnati Gear Company an enviable reputation. So, no matter what your gear requirements might be—no matter how large or small the order—write, wire or call for estimates, prices and complete details

Spur
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***Coniflex Bevel**
Spiral Bevel
Spline Shaft

**Reg. U. S. Pat. Off.*

THE CINCINNATI GEAR COMPANY

"Gears . . . Good Gears Only"

Wooster Pike and Mariemont Ave. • Cincinnati 27, Ohio

in many of these shops were the old types of books—always bound volumes—and these were relegated to the ashcan many long years ago.

It was during the early days of my apprenticeship that the first time-clocks were hesitantly installed, and even these were assumed to be greatly superfluous.

Prior to that time the foreman carried a small book, usually in his vest pocket, and in this he recorded the amount of time which a man in his department lost on account of illness, going on a bender, or other necessary evil. In this book he also kept the dates upon which a new man came into his department to work.

From time to time our shop had the usual line of worthless experts—one of whom claimed that he was the last word as an expert on any type or make of milling machine, no matter what. He had been instructed to report for work on the following Monday, and he came to the shop as agreed. He was immediately set to work cutting the teeth of a gear wheel about 24 in. in diameter, 12-pitch.

At eleven o'clock he went to the foreman, just as the latter was in a sweat over a difficulty on another machine, and told him that on the blank he had room for two very small teeth or one quite large one. We'll close the door on the act of vaudeville which followed and leave the reader to assort his own ideas on the subject.

There are good men who are slow and fast men who are not so good, and records are kept to indicate which is which.

About 1903 an automobile manufacturer installed a number of semi-automatics, one of which was guaran-

"The people who sold us that machine recommended him."

MAXITORQ

KEEPS GOOD COMPANY

The Maxitorq floating disc Clutch was selected as standard equipment in 1949 for the 4 sizes of the Pipe Threading and Cutting machines manufactured by the Bignall & Keeler Division of John Ramming Machine Co., St. Louis.

Their chief engineer says, "During this time we have had no service trouble involving the clutch or drive. Accessibility of the clutch and simplicity of its adjustment have contributed to a most successful design."

Maxitorq engineers are always pleased to see an application such as this, where it is possible to adjust or replace the clutch without tearing down the machine. One of our design objectives is to get more machine builders to adopt this policy. Maxitorq, however, gives top performance wherever it is installed.

If you require smooth, reliable power transmission within the Maxitorq range (8 sizes from fractional to 15 H.P. at 100 r.p.m.) single or double, wet or dry . . . ask our engineers for recommendations. Design is compact, streamlined . . . completely assembled on body and shipped ready to slip onto a shaft. Separator Springs prevent drag, abrasion, and heating in neutral . . . all assembly, adjustment and take-apart are manual operations.

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THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

STEP UP PRODUCTION

with

PRESS-RITE

OPEN BACK—INCLINABLE

POWER PRESSES

Visit our Booth #1467 National Metal Show, October 20-24, Philadelphia, Pa.

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PRESS-RITE Power Presses are crammed with features which give you more day-in, day-out production . . . per machine . . . per operator . . . per dollar invested.

- Press-Rite Airtex Clutch-Brake System (Optional on all presses 20-ton capacity and over)
- Triple Raceway Lubrication
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- Extra Heavy Construction

. . . and many others!

Nos. 60 and 85 Also Available in Back-Geared Types.

Beat competition to the punch! Plan now to modernize your operations with Press-Rite Power Presses. *Write today for New Press-Rite Bulletin P-552!*

Sales Service Machine Tool Co.

PRESS RITE PRESSES • SHAPE RITE SHAPERS • KELLER POWER HACK SAWS

2347 UNIVERSITY AVENUE · ST. PAUL 4, MINNESOTA

SSMT

teed to turn out 200 pistons in ten hours. An old mechanic, "Uncle Silas," made a wager with the manager that he could turn out more pistons than the machine.

Now Uncle Silas was one of the exceptional men, for he was both good and fast on any job. At the end of ten hours the machine had turned out its quota of 200 pistons, while the old man had turned out 202. He was $10 to the good. He made a bet that he could turn out 220 pistons in ten hours, and won that wager too, and his record stood for some time.

Real records are necessary during this mechanical age of specialized operations, for when there is a lag in production they show whether a man is working at a profit, or if he is a boarder. Don't forget that the profitable man is the necessary one.

The man who can put out more finished products of first-class quality is the man to hold on to if the department is to keep abreast of the remainder of the shop.

His timeclock card will show whether or not he is at work. His job card will show when he began the work, and the hour and minute when he finished it, also the number of pieces he worked on. The inspection card will disclose any rejects. These three cards are sent to the cost-accounting department and the proper entries made, including rejects. These enable the department to determine the price of each good piece.

If these procedures and methods are followed, there is very little extra work required of the foreman and, if the department is large, a clerk usually does the record-keeping, and so relieves the foreman of it.

No, such records are necessary today in order to inform the brass

"I put my lunch on that long table and hardly turned my back—"

Latrobe to Display Mammoth Bar of High Speed Steel

New Development to be Featured at A. S. M. Show

Latrobe Steel Company, well known producers of quality tool steels, will exhibit at the Philadelphia A. S. M. Exposition (October 20-24) a bar of "DESEGATIZED" high speed steel — 10 inches in diameter and 10 feet long, weighing approximately 3,000 pounds.

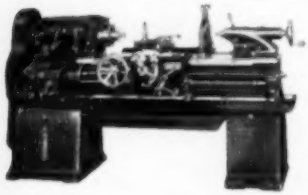
This is the largest bar of high speed steel ever made and is free of carbide segregation throughout.

Carbide segregation and its harmful effects have long been a problem in the manufacture and heat treatment of high alloy tool steels. Latrobe Steel Company, who introduced "DESEGATIZED" high speed steels and high carbon-high chromium die steels in 1946, states that it is now possible to manufacture sizes free of carbide segregation to meet any current and foreseeable needs for these steels.

NOW! Even *Finer*

BRADFORD *Metalmaster* LATHES

12", 14", 16" (Rated Size) Engine & Toolroom Lathes



14½", 16½", 18½", actual swing

BRADFORD Metalmaster Geared Head Lathes have earned an enviable reputation through the years for high efficiency and dependable accuracy. But today's new Metalmaster is even finer. Precision-built of finest materials and components, these lathes are equipped with many outstanding features normally found only on the most expensive lathes.

Where greater power is required the Series "H" Metalmaster is recommended as a 7½ h.p. motor can be used on the 12" and 14" lathe and a 7½ or 10 h.p. on the 16" lathe. Same general design as regular model.

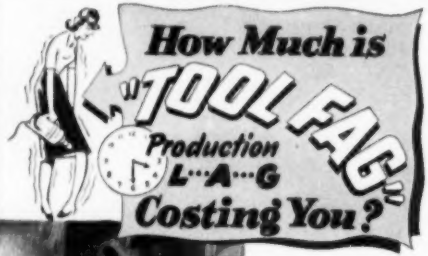
Before you make a lathe investment, investigate the new Metalmaster. Write for Bulletin No. 179.

STANDARD EQUIPMENT FOR METALMASTER LATHES

- 12 Speed Timken Geared Head
- Quick Change Gear Device
- Double Wall Apron
- Tailstock · Compound Rest
- Steady Rest
- Face Plate
- Dog Plate
- Head Center
- Bushing Shear Wipers
- Chasing Dial (Not furnished on Metric Lathes)
- 2 Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button Starter
- Vee Belt Drive
- Automatic Lubrication in Head
- Cabinet Legs
- Lever Control for Length and Cross Feeds
- Mechanical Apron Clutch Control
- L-1 Taper Nose Spindle
- A Complete Line Accessories

NOTE:
14" Lathe Available For December Delivery on Unrated Orders, Subject to prior sale.

THE BRADFORD MACHINE TOOL CO.
664 EVANS STREET CINCINNATI, O.
Precision Since 1840



Prevent this LOSS with

Mall

Pneumatic
Shop Tools

Turn out more work, easier, faster, with lightweight, vibrationless tools that reduce fatigue to an absolute maximum. Typical of Mall compactness and precision in pneumatic tools is this No. PG-K1030L Lever Throttle Die Grinder, weighing only ¾ of a pound and easily held in the palm of the hand. With a guaranteed speed of 30,000 rpm. and a maximum of .0015 runout at the collet, this Mall Pneumatic Die Grinder assures accuracy, precision and ease of operation.

Send For Complete Illustrated Bulletin With Price List.
40 Factory-Owned Warehouses, Coast To Coast, To Serve Our Customers.

Mall
TOOL COMPANY
7721 S. Chicago Avenue
Chicago 19, Illinois

as to whether the department is doing its share of the work, and if not, an investigation becomes necessary and corrections are made.

Al is right in cooperating in this matter of records, while Ed . . . oh, my.

Robert Lee Grayford
Worcester, NY

•

WEARING OFF THE GREEN

I THINK THERE is much to be said for Al's idea of spending time with the new employees. Not only will it save him a lot of time and headaches breaking in these men right, but he will get closer to the men than if he merely hands them a blueprint and material and leaves them to their own devices.

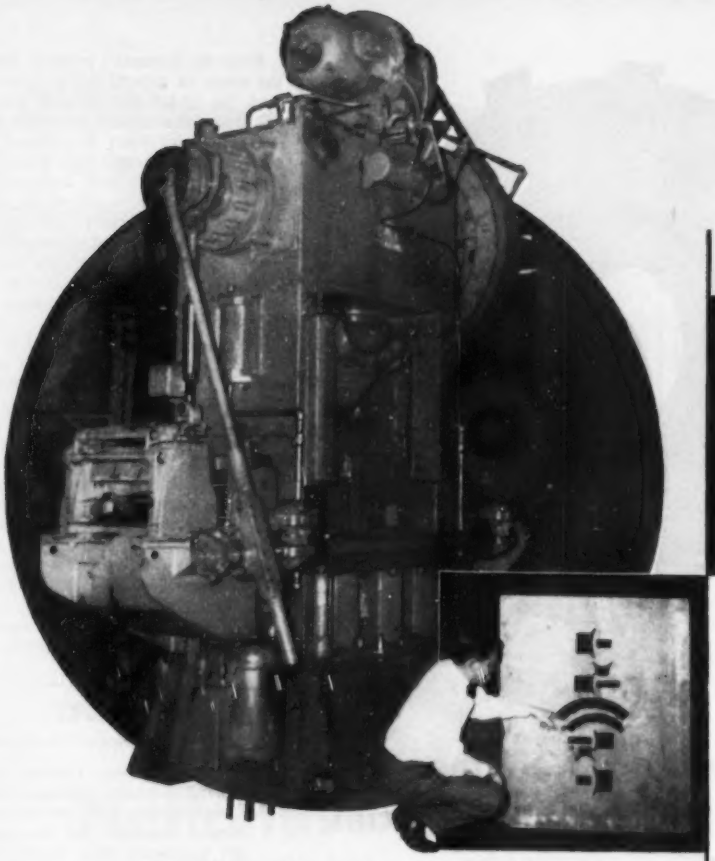
From my own experience as a young journeyman, I can remember going into shops where the new man's introduction was of a very casual nature—usually confined to a curt briefing on where to hang up one's clothes, the location of the toolcrib, and the machine or machines where the work had to be done, and, finally the blueprint or sketch of the work itself.

From then on in your were on your own. If the men close by were of a congenial type, and didn't mind answering any questions pertaining to the work or the machines, then things moved along pretty well.

If the reverse were the case, and you had fallen among some tight-mouthed individuals who were inclined to make a closed corporation of the place, then you had a hard row to hoe.

Lathe-dogs and other simple tools that were necessary, and should have been handy, were conspicuous by their absence. If you were of the not-easily-discouraged type, and stayed a while, you found out later that these tools were hoarded and locked away in bench drawers and cupboards, grudgingly disgorged only at the voice of authority. Yes, these tools were company property, but the oldtimers felt they had some prior claim to them, and believe me, they were reluctant to relinquish that claim!

On the other hand, I have worked in shops where the foreman took me around and showed me all the facilities, usually with a certain amount of pride, introduced me to the men in my vicinity, and explained the work I had to do in considerable detail. From then on I really felt I had an interest in the place, and it was a pleasure to go to work in the morning.



Template shows sizes and shapes of laminations produced in this operation

LOGICAL CHOICE

This Clearing press in the new multi-million dollar "dream plant" of Lincoln Electric Company at Cleveland is producing laminations at 150 strokes per minute, with automatic feed and scrap cutting. Perhaps no manufacturer is better known than Lincoln Electric for its unremitting attention to costs, coupled with a famed incentive system that gives its workers an average yearly wage exceeding $7,000.

Only the most efficient equipment can win a place in such a plant. It's no coincidence that Clearing presses are commonly found in plants that are setting new standards for industry. Clearing presses have been setting new standards on their own—new conceptions of speed, of accuracy, of die life. It will pay you to check with Clearing engineers for a forward-looking answer to your press problems.

CLEARING MACHINE CORPORATION

6499 WEST 65TH STREET ★ CHICAGO 38, ILLINOIS

HAMILTON DIVISION, HAMILTON, OHIO

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

...the word from the wise in milling cutter circles

The modern Lovejoy line of inserted-tooth milling cutters are ordered and reordered on the basis of performance. Proof? . . . our first customers are still with us after 30 years of satisfaction.

The modern Lovejoy line has never been more complete. Improved new designs, both standard and special, are coming constantly from our large engineering staff.

The modern Lovejoy line features the exclusive "positive-locking" device to allow maximum use of each blade and minimum loss in sharpening.

The modern Lovejoy line of milling cutters, boring tools, arbors, flywheels, etc., plus outstanding field service, can help you cut your production costs, just as it has for others.

128 MAIN ST., SPRINGFIELD, VERMONT

WRITE FOR FREE CATALOGS

LOVEJOY
TOOL COMPANY, INC.

From the foreman's point of view, the more he gets to know about a man, the better able he is to judge his capabilities and fit him into the organization. I don't mean that he should hang around and breathe down the fellow's neck while he is working, because very few men react kindly to such close supervision. But it is a simple matter to gain a man's confidence once you have made it evident that you wish to make his stay with the company as pleasant as possible.

The average man is inclined to be tense going into a new job. If you can relax that tension by a friendly attitude toward the new employee, you have gone a long way toward establishing friendly labor relations between the man and the company.

Don't forget, you as foreman have a selling job to do for the company you represent; by making a man's working conditions pleasant you sell him the idea that here is an organization worth working for, and he will react accordingly.

Robert S Alexander
Greenville, RI

NEW BOOKS

TAPS AND DIES FOR UNIFIED AND AMERICAN SCREW THREADS—*Published by Tap and Die Division, Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. 7 pages, 8½ x 11 in. Price, 50 cents.*

In development of the Unified thread system, the purpose was to minimize tooling changes in the United States, because of the size of its industry relative to those of England and Canada. This is explained in these new tap tables. Pitch-diameter tolerances of the nut and screw in the American National thread form are equal, with the nut above and the screw below basic. On the other hand, in the Unified series, to compensate for manufacturing difficulties, the tolerance of the tapped hole is always 1.3 times the tolerance of the screw for the corresponding class. Tapped holes passed as satisfactory for the National Classes 2 and 3 are satisfactory for Unified Classes 2B and 3B.

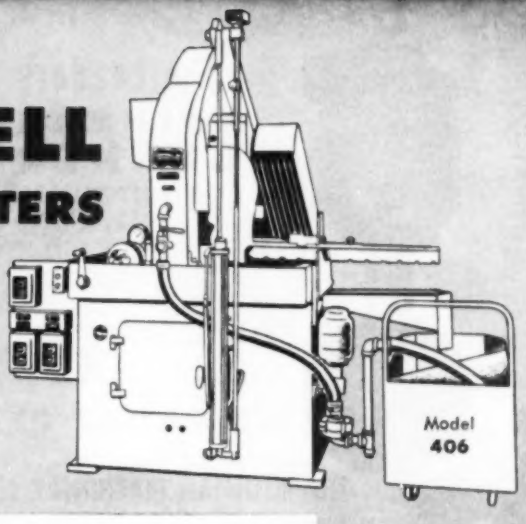
The Metal Cutting Tool Institute has recognized, however, that a ground-thread tap larger than the original commercial ground-thread tap may give improved performance on Class 2B holes in sizes ¼ to 1½ in., if the tap size is properly selected

ACCO products

See These Machines–

CAMPBELL
ABRASIVE CUTTERS

For fast, clean, accurate cutting of hard, soft, round, hex, square, or shaped stock



...at the

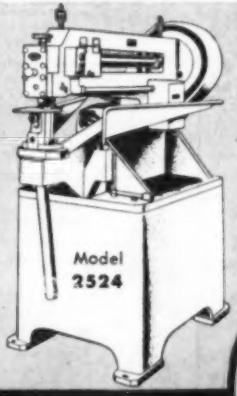
National Metal Show

CONVENTION HALL • PHILADELPHIA

OCTOBER 20-24 • BOOTH 706

CAMPBELL
NIBBLERS

Cut odd shapes from ferrous or non-ferrous shapes



ACCO

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CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

923 Connecticut Ave., Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibblers

OK'ed by

The Leaders

RUTHMAN GUSHER COOLANT PUMPS

Here is why leading machine tool manufacturers continually use Gusher Pumps as standard equipment on their machines. Gusher Pumps deliver instantaneous coolant flow . . . no packing or priming is necessary . . . pre-lubricated heavy-duty ball-bearings require no further attention . . . maintenance cost is cut to a minimum. Electronically balanced rotating assembly plus overall simple construction reduces wear.

Follow the leaders — Specify Gusher Coolant Pumps.

THE RUTHMAN MACHINERY CO.

1818 Reading Road, Cincinnati, Ohio

di-acro

PRECISION MACHINES

for Die-less Duplicating

See the Complete line

BOOTH 630

National Metals Exposition
October 20-24
Philadelphia

Or send for New 32 page Catalog

O'NEIL-IRWIN MANUFACTURING CO.

311 8th Ave., Lake City, Minnesota

and the tap is kept sharp. Thus "commercial ground high" or CGH taps, have been introduced. Four series of taps are therefore provided: 1) the usual cut thread; 2) a PGI series, known as "precision ground No. 1 limit," with the minimum pitch diameter set at basic; 3) an altered CG, or commercial ground series, where the tolerance spread has been shifted a few thousandths toward the basic pitch diameter, and 4) a CGH series, or commercial ground high, where the tolerance spread has been shifted so its maximum is above the former maximum for the commercial-ground series.

These CGH and CG taps, in addition to the revised precision-ground taps are adequate for tapping all Class 2B and Class 3 Unified holes and they will also tap Class 2 and Class 3 National holes formerly tapped with the original commercial-ground and precision-ground taps. The tables give recommendations for type of tap for the various classes of thread, thereby saving involved calculations and references.

•

That Night Man

The orders are coming in bunches,
and the castings pile up on the floor,
The big shots convene, around my machine, so I can't walk around anymore.
I thought it was bad when it started,
but I didn't know what was in sight,
'Til I found they had hired a novice to run MY machine every night.

Now this kid is just fresh out of trade school, and could talk about theory for days,
But he always leaves grease on the handles, and he never puts oil on the ways.
'Though I've run this machine since they bought her, and know all the tricks in her store,
Since they hired this fool, she just balks like a mule, and I can't hold a size anymore.

Now, I've studied machines since my early teens, and my knowledge of shop work is clear,
But the things that it took me a lifetime to learn, he claims to have learned in a year.
I could stand all his ego and boasting, but my pride has been shattered to see,
That his setups are better than mine are, and he's turning more casting than me.

—S F Perkins, Jr

KENT-OWENS BUILDS 'EM

RUGGED

TO KEEP YOUR PRODUCTION UP AND COSTS DOWN!

Maybe we're "sticking our neck out"—but we think your toughest milling problems can be handled *right* with Kent-Owens Machines!

On countless jobs—these Milling Machines have shown ability to turn out the work with top speed and high accuracy. They're outstandingly rugged . . . efficient . . . dependable. Designed with practical features that help you *produce more* . . . with *lower costs!*

The Kent-Owens Standard line includes a wide range of hydraulic and hand operated machines. Let Kent-Owens engineers recommend machines and tooling best suited to your requirements. Write us about your needs. Kent-Owens Machine Company, Toledo, Ohio.

Call on

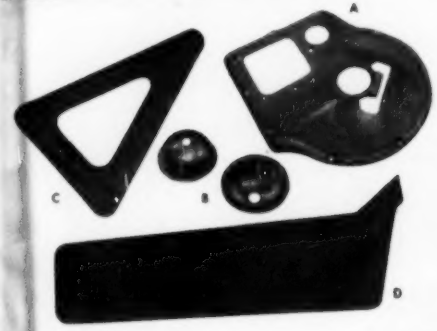
KENT-OWENS

for Milling Machines

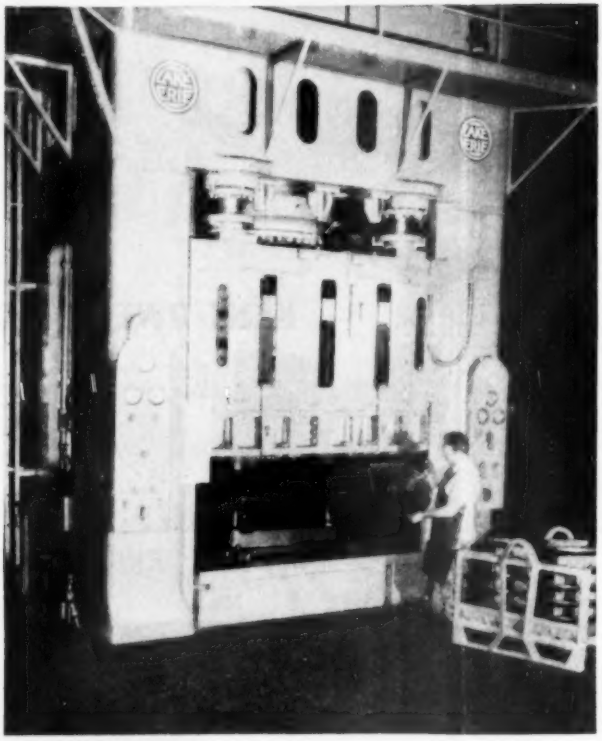
CATERPILLAR TRACTOR CO.

demonstrates the **wide applications** of Lake Erie Hydraulic Presses

A good example of the great variety of money-saving opportunities for hydraulic presses in the modern metal working plant.

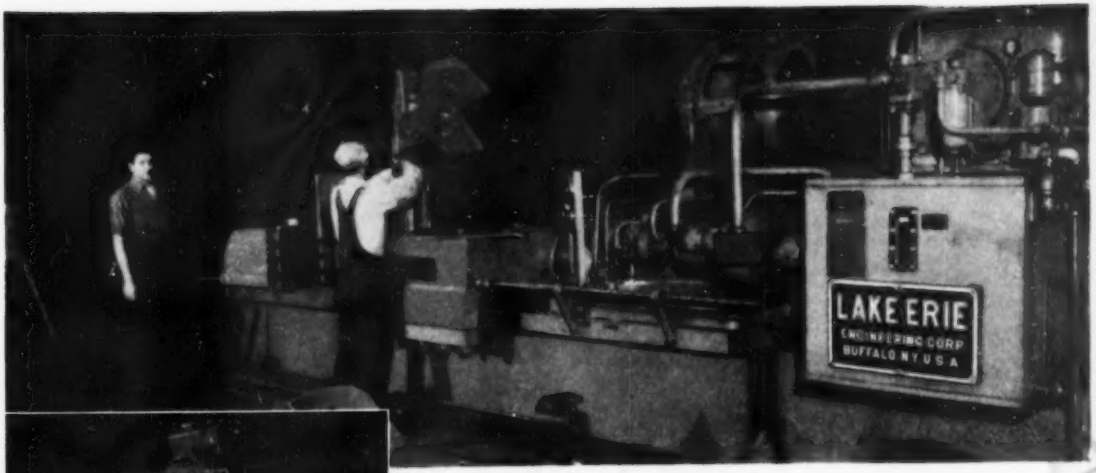


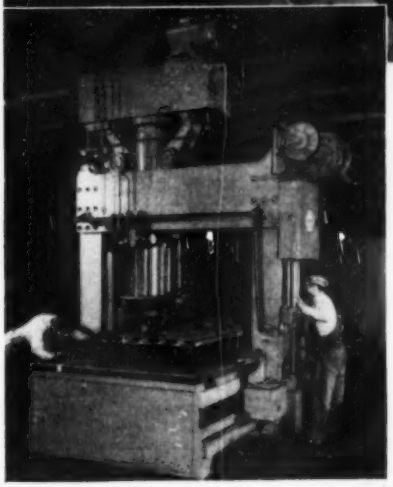
TYPICAL PIECES FORMED ON PRESSES. (A) Steel cover 35" long, 26" wide and $\frac{7}{32}$" thick is blanked and drawn in a single operation with 1200 tons pressure. Cover is pierced, trimmed and restruck on smaller hydraulic press after blanking and drawing. (B) King bolt liners formed out of .134" hard brass are 8" in diameter. Pieces are blanked, drawn and coined on the 500 ton Lake Erie press. (C) Earth-moving bulldozer lifting crank 24"x24"x12" outside, 12"x12"x10" inside x 1" thick blanked in a single operation. (D) Blank for earth-moving bulldozer end plate is 10" wide at one end, 12" at other, 54" long and $\frac{3}{8}$" thick.



2000 TON DOUBLE ACTION PRESS. This press has a 500 ton hydro-pneumatic die cushion, bed size of 96"x96" and daylight opening of 60". It is used generally for forming large pieces requiring high tonnage, but is also used for heavy blanking jobs.

750 TON SINGLE ACTION PRESS *left* —500 TON DOUBLE ACTION *right*. These presses are used for a wide variety of forming operations including blanking, bending, drawing, piercing and coining. The pieces illustrated at left above are a few examples of the work done on the three presses shown on this page.





500 TON HYDRAULIC BULLDOZER.
This widely-used horizontal press is shown hot forming draft frame reinforcements. Pieces are ⅜" thick, 30" wide and approximately 4' long before bending. A pressure of 400 tons is used.

200 TON TRAVELLING HEAD STRAIGHTENING PRESS.
A versatile, highly accurate press that is very much in demand. Used to straighten all types of weldments such as bulldozer blades and other large weldments, some of which appear in lower right corner of photo.

● The piece shown above is another example of hydraulic bulldozer work. It illustrates draft frame bottom plates which are hot formed from ⅜" thick stock 7½' long before bending. Draft frame reinforcement also formed on hydraulic bulldozer is shown at left.

THE ABILITY OF LAKE ERIE HYDRAULIC PRESSES to perform a multitude of production jobs that save time and money, simplify design and assembly, and result in a better product for the manufacturer is amply demonstated at Caterpillar Tractor Co. A catefully selected group of Lake Erie hydraulic presses is busy doing a wide variety of metal forming work. This includes hot and cold bending, drawing, straightening, blanking, piercing, coining, and many other operations, a few of which are illustrated on these pages.

It is hard to conceive of a metalworking plant today that wouldn't benefit immensely through the use of one or more of these hydraulic presses—possibly a hydraulic bulldozer... or a straightening press... or a single action press with die cushion... or some other type or combination of presses. Why not discuss this possibility with our engineers? We have developed more than 3,500 designs for hydraulic presses to meet practically all needs. We serve the leaders throughout industry with complete satisfaction. We can do it for you. Write or phone today.

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Manufactured in Canada by: Canada Iron Foundries Limited

LAKE ERIE HYDRAULIC PRESSES are available in any size... standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Die Casting—Briquetting—Baling—Special Purpose. LAKE ERIE ®

● **Designers and builders of the most complete line of Hydraulic Presses for the manufacturing industries**

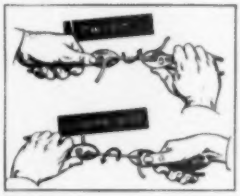
VISIT the Chase booth no. 1200 at the National Metal Congress and Convention

CHASE® WIRE gets a "physical" to make your products better

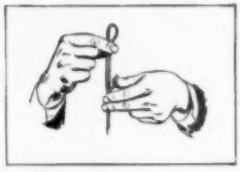
Chase wire is carefully inspected and tested to catch any defect.

In addition to the usual tensile strength tests, it is tested for slivers or any other physical or surface defect not possible to detect by visual inspection.

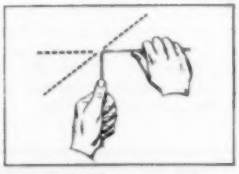
Because of the high ductility and malleability of Chase wire, it is superior for cold-heading, drawing, forming, shearing and many other operations. Chase brass wire is available in a wide range of color from copper red to golden color.



TEST NO. 1. Chase wire is twisted ten times in each direction to reveal seams, slivers, as well as other irregularities.



TEST NO. 2. Only wire of the very highest quality can pass this exacting 360 degree wrap-around test for forming.



TEST NO. 3. Chase wire is bent sharply at right angles in four different directions to reveal possible brittle condition.

Chase® BRASS & COPPER

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Chicago	Houston†	Newark	Rochester†	(Trailer office only)
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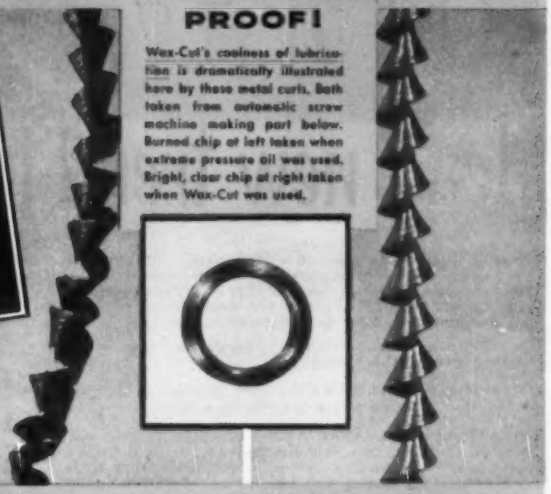
FAR GREATER LUBRICITY!

JOHNSON'S
WAX-CUT



PROOF!

Wax-Cut's coolness of lubrication is dramatically illustrated here by these metal curls. Both taken from automatic screw machine making part below. Burned chip at left taken when extreme pressure oil was used. Bright, clear chip at right taken when Wax-Cut was used.

THE NEW WAX-TYPE CUTTING OIL

Johnson's No. 120 Wax-Cut is a new *wax* cutting fluid that has *proved* its many benefits over sulphurized and chlorinated oils. On automatic screw machines, gear cutting machines, and other machine tools requiring an oil-type cutting fluid, Wax-Cut has overwhelmingly demonstrated: greatly increased tool life . . . better cutting performance . . . *none* of the objectionable qualities of E.P. oils.

Cooler cutting!

These findings are supported by months of exhaustive testing at the University of Michigan and in nationally known production shops.

For longer tool life—The superior lubricity of wax makes possible a coolness of operation that cannot be approached by E.P. oils. In production tests, Wax-Cut extended tool life to a degree operators previously thought impossible!

Increased feeds, speeds . . . improved finish—Wax-Cut's extreme reduction of heat makes increases in cutting speeds and feeds possible in many cases.

For less smoking, burning, atomization—The coolness of operation considerably reduces the amount of daily consumption.

A product of
JOHNSON'S WAX
Research

Non-Corrosive!

Wax-Cut can be used on *all* types of metals! It contains no chemically active additives such as sulphur or chlorine—so it will not stain non-ferrous metals nor attack machine bearings, gear mechanisms or other parts.

Lower viscosity!

Wax-Cut's very low viscosity minimizes the amount of "carry-off." Reclaiming Wax-Cut can prove far more satisfactory than reclaiming present E.P. oils!

Decided operator preference!

For cleaner . . . odorless—Wax-Cut is a golden clear fluid that has no objectionable odor and will not turn rancid. Absolutely harmless to skin.

No mixing, no mess—Wax-Cut comes ready to use . . . no expensive man-hours wasted in mixing additives.

Test Wax-Cut for economy

A test in your own shop will prove longer tool life . . . less down time . . . uninterrupted production—adding up to far lower operating costs.

Send today for complete information!
Industrial Products Dept. AM-10
S. C. Johnson & Son, Inc.
Racine, Wisconsin

LIGHT, VERSATILE, RUGGED DELTA TOOLS lead new trend in Metalworking

There's a basic change going on in the metalworking industry—a wholesome, profitable change, with the pace increasing daily—as alert shop men discover that on many operations light, rugged, versatile Delta power tools can out-perform and out-produce heavier, costlier installations.

These five potent facts go far toward explaining the economic common sense of this change:

DELTA TOOLS ARE ACCURATE—their accuracy is built in, makes close precision tolerances easy to achieve.

DELTA TOOLS ARE ADAPTABLE—unusually mobile and portable, they can be tooled for a given job, kept in the tool crib, then moved into and out of production lines with no lost time for setting up; can be used for continuous high-production runs of single or multiple operations.

DELTA TOOLS ARE DURABLE—rugged to withstand hard usage . . . precision built and beautifully balanced, they perform most efficiently throughout long, useful lives.

DELTA TOOLS ARE ECONOMICAL—first cost is moderate; and is quickly amortized by low power cost, low maintenance expense, increased output and elimination of bottlenecks and slower methods.

Dollar for dollar, Delta tools deliver more. Here are 5 reasons why:

1. Lubricated-for-life ball bearings eliminate lubrication problems.
2. Precision bored bearing seats assure accuracy and smooth operation.
3. Preloaded bearings provide maximum rigidity and accuracy under load.
4. All spindles, arbors and collars are precision ground for accuracy.
5. Dynamic balance of rotating parts insures smooth, true performance.

DRILL PRESSES

With Delta Drill Presses, you can work out any set-up to suit your own need—using one spindle or as many as your job requires. Any set-up you want is not merely possible, but is actually very easy—because Delta drill presses have the flexibility to make them fit readily into any multiple spindle set-up. Low in cost, easy to maintain, readily portable, the Delta Drill Press is a good example of fine engineering, rugged construction and compact design.

A 14" DRILL PRESS

Available with either No. 1 Morse taper spindle or Jacobs chuck that takes straight shank drills from No. 60 to full ½-inch. In high- or slow-speed models. Capacities up to ½-inch in cast iron; ⅜-inch in steel. Quill has 4-inch stroke. Spindles are readily interchangeable—a simple matter to select the right spindle for any job.

B 17" DRILL PRESS

Available with either No. 2 Morse taper spindle or ½-inch Jacobs chuck. In high- or slow-speed models. Capacities up to ¾-inch in cast iron. Quill has 5-inch stroke.

METAL CUTTING

C CUT-OFF MACHINE

Cut steel, aluminum, copper, brass in one fast, easy motion with a Delta Cut-Off Machine. It's easily changed from a non-ferrous to a ferrous cut-off machine by switching from steel blade to abrasive wheel.

D 14" METAL CUTTING BAND SAW

Cuts anything from carbon tool steel to asbestos, in hundreds of applications. Four metal-cutting speeds: 125, 175, 250, 340 f.p.m.—change from metal to wood with just a flip of your finger and simple belt change.

SHAPER

E 7" PRECISION METAL SHAPER

This husky "machine of a thousand uses" is extremely popular in machine shops, tool making and model making shops, schools and experimental departments. "V"-type ways on ram, tool head and front face of main frame insure accuracy and longer life.

FINISHING MACHINES

F DEBURRING Machine

The easy, practical, low-cost way to handle a multitude of metal removal operations. Eliminates bother of "set-up wheels" and dressing of "grinding wheels"—inexpensive, long-wearing abrasive belts are easily replaceable. Much lower in cost than any comparable machine on the market.

G ABRASIVE BELT FINISHING Machine

This 6" belt-type abrasive finishing machine is heavy and husky enough to do dozens of sanding, polishing and finishing operations, yet is portable. Operates vertically or horizontally.

H ABRASIVE DISK FINISHING Machine

This machine is ideal for an accurate, fast finishing job. It can be moved to any place in the shop or on the production line. Abrasive disks can be renewed every few minutes if necessary.

WELDERS

I DELTA Combination 5 KVA SPOT and 120 AMP. ARC WELDER

For any shop doing a lot of light duty production spot welding and intermittent arc welding. Unique design, careful engineering and high production methods permit pricing it considerably under two individual welders.

J DELTA 5 KVA Automatic SPOT WELDER

Compared to other spot welders, this compact unit is conspicuous for efficiency and low cost. It is extremely simple and easy to operate, and has an unusually wide range of capacity.

GRINDERS

K Toolmaker GRINDER

As a Chip-Breaker Grinder. With univise and coolant attachment, the Toolmaker surface grinder is a precision machine which grinds the chip breaker groove in carbide tipped tools.

As a Tool and Cutter Grinder. With the Toolmaker tool and cutter grinding attachment, it becomes an economical machine for easy sharpening of tools and cutters.

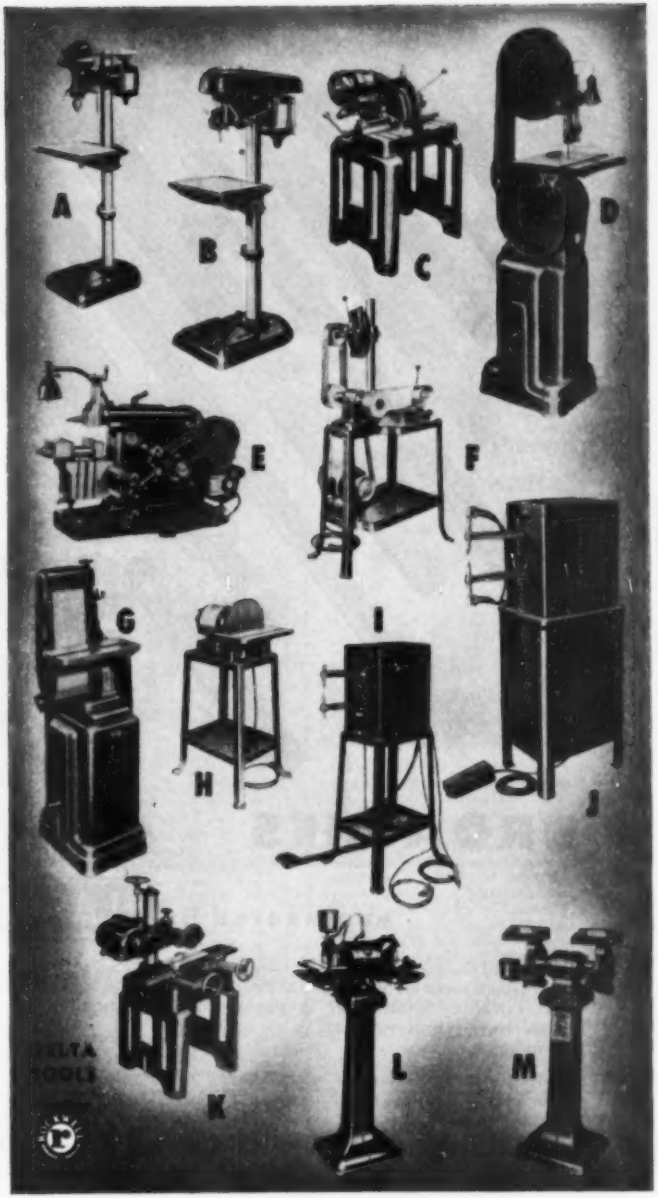
As a Standard Surface Grinder. The basic Delta Toolmaker surface grinder does every type of surface grinding required in the tool room or production shop. It's a big, rugged machine with the massiveness and solidity needed to produce accurate work.

L CARBIDE TOOL GRINDER

Here's the accurate, low cost way to grind your tungsten-carbide tools—the Delta Carbide Tool Grinder. Made in two styles—bench and pedestal—a wide range of motors are available.

M STANDARD TOOL GRINDER

Here's the grinder "that can't forget its goggles." In addition to its unsurpassed safety features, it's a money-saver—sturdy, accurate, highly adaptable, easy to use and low in cost.



There's a Delta Power Tool for Your Job- WOOD OR METAL WORKING 53 MACHINES • 246 MODELS • MORE THAN 1300 ACCESSORIES

DELTA POWER TOOL DIVISION

Rockwell Manufacturing Company

618L North Lexington Avenue • Pittsburgh 8, Pa.

BE SURE TO SEE
all of these tools demonstrated
under power at the
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Philadelphia • October 18-24

engineered by LAPOINTE

embody all the accumulated experience of our 50 years as **pioneers** in the art of broaching. This valuable "know-how" is put at your disposal every time you send us an order or an inquiry.

Being the world's largest manufacturer of broaching machines and broaches, it is of course to be expected that **our facilities for producing broaches of any size or shape, in any quantity, cannot be equalled.**

Recent plant expansion has still further increased our capacity to produce broaches . . . although we are already the largest producer of broaches in the industry!

It is definitely to your advantage, when you need broaches, to look to the leader . . . look to **LAPOINTE!**

Send for our brochure on broaches. Ask for Bulletin B-2

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HUDSON, MASSACHUSETTS • U. S. A.
Branch Factory: Watford, Herts., England

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

IN ALL INDUSTRIES

LUBRIPLATE LUBRICANTS

EXCEL IN REDUCING FRICTION, WEAR, UPKEEP-COSTS AND POWER-CONSUMPTION... WITH BETTER MACHINE PERFORMANCE

"THIS LUBRICANT CUT OUR PARTS REPLACEMENT 50%"

– says NORTHERN PACIFIC TRANSPORTATION COMPANY

"LUBRIPLATE proved so satisfactory during tests that we installed it in all our worm-gear, hypoid, and two speed axles. This enabled us to change our oil-change period from 15,000 miles to 40,000 and on some applications, depending on speeds and temperatures encountered, we raised the change period to 60,000 miles, or approximately once a year. Our overhaul periods were stretched from 50,000 to 100,000 miles, and repair parts bill cut 50% with the increased mileage."

THE GLOBE COMPANY says:

"THIS LUBRICANT INCREASED BEARING LIFE FROM 2 WEEKS TO 2 YEARS"

"After we had quite a few of our large high speed ROTO-CUT meat cutting machines in actual production operation, the ball and spherical roller bearings on the cutter shaft gave us serious trouble due to a condition that prevails throughout the meat packing industry, animal acids and moisture. Some bearings did not last even two weeks. Then, BALL BEARING LUBRIPLATE was called to our attention. The result: these machines lubricated with BALL BEARING LUBRIPLATE have been in continuous operation for over two years without a single bearing replacement.

The Globe Company
Frank J. Bilek (Chief Engineer)

"THIS LUBRICANT kept 'em rolling in mud, muck and water"

– says J. O. ARCHIBALD of Redwood City, California

"Due to our success on similar work, The Leslie Salt Company gave us the contract for the conversion of 500 acres of salt marsh into crystallizing ponds. Knowing from experience that LUBRIPLATE No. 107 reduced friction to a minimum, and prevented rust even in salt water, we adopted it for track and general lubrication. We selected LUBRIPLATE APG-140 for all transmissions and final drives. The effectiveness of LUBRIPLATE is evidenced by the fact that during the entire job there were no replacements of track rollers nor were there any tie-ups of equipment due to replacement or breakage."

J. O. Archibald

REGARDLESS OF TYPE AND SIZE OF YOUR MACHINERY LUBRIPLATE LUBRICANTS IMPROVE OPERATION AND GREATLY REDUCE MAINTENANCE COSTS.

Write today for LUBRIPLATE Data Book No. 1-52

LUBRIPLATE DIVISION
Fiske Brothers Refining Co.
Newark 5, N. J. Toledo 5, Ohio

DEALERS FROM COAST TO COAST—SEE YOUR CLASSIFIED TELEPHONE BOOK

MUELLER BRASS CO. ALLOYS FOR AVIATION'S TOUGHEST APPLICATIONS

"803" • This Mueller Brass Co. alloy is a high silicon iron-copper bronze ideally suited for roller bearing cages and other specialty parts in jet aircraft. It has good machinability and is extremely ductile. "803" metal is non-galling and retains its excellent mechanical properties up to 500° F. This alloy available as forgings—but not as rod or castings.

"600" SERIES • "600" series are high strength bearing bronzes that do not contain any hard-to-get tin. They can be forged into relatively complicated shapes that are closer to size and require less machining than sand castings. "600" series metals have a low coefficient of friction and a tensile strength 2½ times that of the cast phosphor bronzes. They are highly resistant to wear and corrosion. These properties make "600" series highly desirable for use as parts on hydraulic equipment, actuators and instruments in jet aircraft. "600" series metals are available in standard or special extruded shapes up to 12' mill lengths. There is a "600" series alloy to suit your special bearing metal needs.

TUF-STUF • Mueller Brass Co. TUF-STUF aluminum bronze alloys have found wide acceptance for jet aircraft parts like the rotor for hydraulic pumps and other vital jet engine parts that must stand up. TUF-STUF alloys are corrosion resistant . . . strong and light and extremely long-wearing. They resist oxidation, even at high temperatures. TUF-STUF alloys are available in the form of forgings, rods and screw machine parts. They fill Federal Specification QQ-B-666, Grade B, and several other variations.

For complete information about "803" metal, the "600" series alloys and TUF-STUF, write today to

82

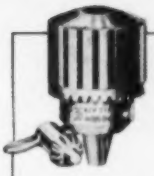
MUELLER BRASS CO. PORT HURON 18, MICHIGAN

BRIGHT SPOT *in your production picture*

Industry's Overwhelming First Choice for top performance under toughest conditions of heavy duty drilling is the Jacobs Ball Bearing Super Chuck. Precision-built for high accuracy and tremendous strength . . . plus the most powerful grip ever devised . . . it is one of the most dependable of all production tools.

Jacobs Chucks are stocked and sold by your Industrial Supply Distributor.

The Jacobs Manufacturing Co., West Hartford 10, Conn.



Another World Leader. The same special steel alloys, rugged construction and precision craftsmanship combine to make the Jacobs Plain Bearing Chuck unequalled for light and medium duty drilling. It is the world's most widely used chuck.

IF IT'S A

JACOBS

IT HOLDS

VASCO SUPREME

. . . will do more AND OTHER

High Speed Steel will do . . .

. . . does most of the jobs done by

other High Speed Steels . . . 5 OR MORE TIMES BETTER!

There's only one Vasco SUPREME . . . unapproachable for high production performance; cuts harder materials and can be used at speeds 15 to 100% higher than other high speed steels. Hardened and ground flat tool bits now available from stock. Do you have the remarkable facts on this High Speed Steel?

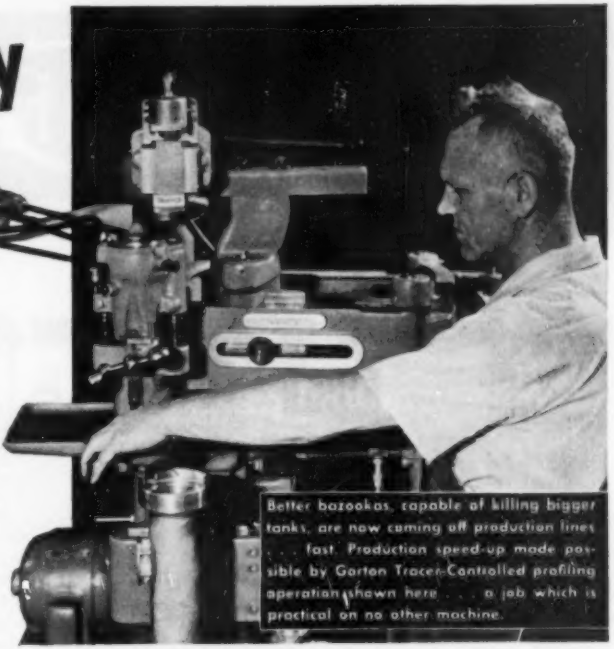
Vanadium-Alloys

STEEL COMPANY

LATROBE, PA.

COLONIAL STEEL DIVISION • APOLLO-KEYSTONE DIVISION

Pantography at Work!



Better bazookas, capable of killing bigger tanks, are now coming off production lines . . . fast. Production speed-up made possible by Gorton Tracer-Controlled profiling operation shown here . . . a job which is practical on no other machine.

★

Inside profiling operation produces more than 36 pieces per hour with Gorton Tracer Control. Approximate time by the next best method . . . one piece every two hours.

GORTON

- **IMPROVES QUALITY**
- **INCREASES PRODUCTION**
- **CUTS COSTS**

On many all-but-impossible jobs, Gorton Tracer-Controlled Pantographs and Duplicators speed up production on military or industrial contracts. High surface finish results from spindle speeds up to 45,000 R.P.M. Accuracy results from the use of over-size masters, patterns, or templates together with the reduction ratio which is exclusively characteristic of the pantograph. Whether a dozen or a thousand pieces, each is identical to the first. Work piece size varies from instrument parts to areas of 10 by 20 feet.

Gorton tracer-controlled equipment quickly pays for itself in profiling, routing, die sinking, mold cutting, counterboring, chamfering, grooving, graduating, engraving as well as many other standard or special operations on ferrous or non-ferrous metals and plastics where work is flat, uniformly curved, cylindrical, spherical or irregular in shape.

Mail the coupon below for General Catalog illustrating the complete Gorton line.

PRODUCTION DATA—

JOB: Profile 6 locking lugs for male and female sections of new 3.5" Bazooka.

MATERIAL: Aluminum alloy.

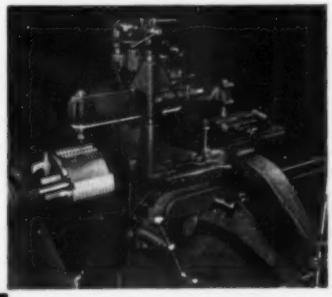
CUTTER: 5/32" dia. single flute, fast spiral H.S. steel running at 3,900 R.P.M., without coolant.

MASTER: 2 masters: one for male and one for female sections; 3 times oversize, traced manually.

HOLDING FIXTURE: Pneumatic-operated internal expanding type.

APPROX. TIME: 36 pieces per hour.

ALTERNATE METHODS: None practical.



THIS OPERATION SPEEDED UP 6 TIMES

Gorton Tracer Control chamfers ends of interrupted threads in breech ring and on breech block of 155 mm. gun. Previous time, 4 hours; Gorton time, 40 minutes.

GEORGE GORTON MACHINE CO.

1510 Racine St., Racine, Wis., U.S.A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-1510

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Name .....

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P3554-R

Ninety years of SIP development

1861 The picturesque villa where the SIP was founded

Auguste de la Rive, one of the founders of the Société Genevoise d'Instruments de Physique, had for years devoted himself with passion to research on laws of physics and optics. But advance in this field was dependent upon the possibility of equipping laboratories with the instruments indispensable for carrying out experiments. At that time, such instruments were practically unavailable. De la Rive realized that he would have to build them himself.

Auguste de la Rive
1801 - 1873

Marc Thury
1822 - 1905

With much difficulty, he succeeded at last in collecting a small capital and opened in 1861 with Marc Thury, a professor at the University of Geneva, a modest shop in a villa outside the town.

The establishment which was to become the Société Genevoise began on a timid scale, but ploughed its way firmly ahead, raising the manufacture of mechanical and physical instruments to such a high level that the small works became a veritable school of high class mechanics to which many foreign undertakings sent their workmen to complete their training.

In 1863, the first catalogue was issued and it is amazing to note the large amount of items already listed ; vacuum pumps, spectrometers, composite microscopes, photometers, galvanometers, etc.

A delicate problem had to be solved in relation with the manufacture of physical instruments : the automatic ruling of accurate divisions.

A linear dividing engine of a precision unheard of at that time was built and this enabled the firm to supply also

standard scales

to Bureaux of Weights and Measures all over the world.

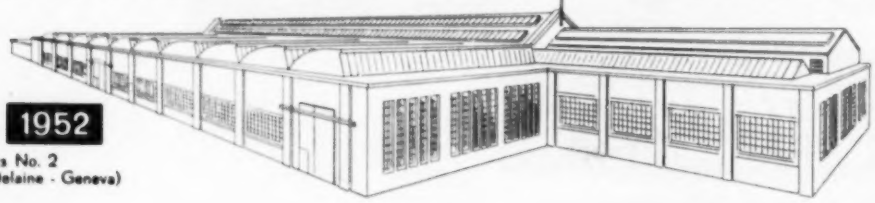
A circular dividing machine was developed in later years and won for the Geneva works a wide repute in astronomical and scientific instrument making.

Various testing appliances were furnished to leading metrological institutes in Europe and the United States.

Industrial applications of metrology followed, and new buildings had to be erected to meet the demand for measuring machines, dividing engines, screw cutting lathes, etc.

As far back as 1912, the very first "pointing machine" was listed in the SIP catalogue. It was claimed to permit "the accurate location of a series of points distributed in a plane". The idea of the jig borer was launched and, in 1919, appeared the MP-1 Jig Boring Machine intended for watchmakers. Larger models were soon marketed and met with great success in wide industrial circles.

In 1934 a new impetus to the Company's activity was given by the creation of the combined "Hydroptic" Jig Boring and Milling Machine which set a new standard of precision.

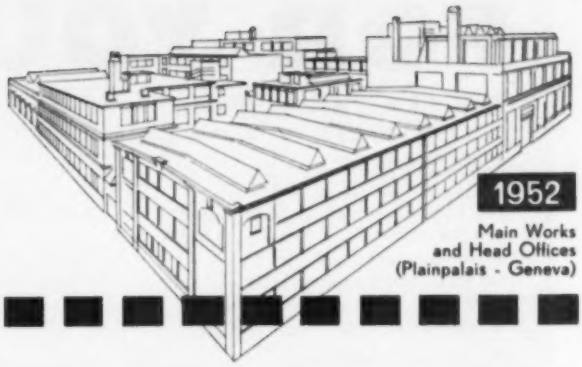


1952

Works No. 2
(Châtelaine - Geneva)

A16

To day, the SIP manufacturing program includes various measuring machines and testing instruments, and a comprehensive range of optically set Jig Borers with **built-in standard scales** which ensure the absolute permanence of the accuracy, while viewing screens provide exceptionally easy settings.



1952

Main Works
and Head Offices
(Plainpalais - Geneva)

Partial View of the Châtelaine Works

REPRESENTATIVE FOR U.S.A. AND CANADA:

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS AND MEASURING EQUIPMENT

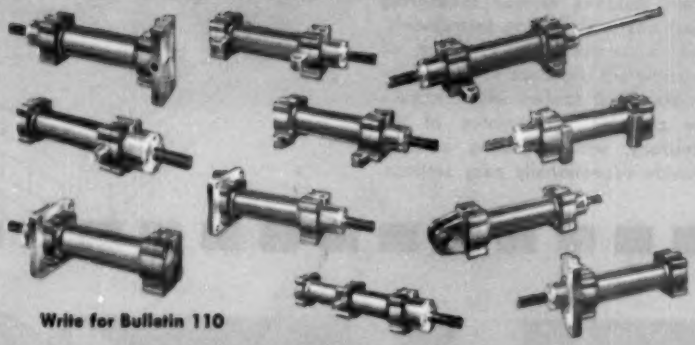
100 East 42nd Street NEW YORK 17, N.Y.

A16

FOR YOUR

SERIES "N" HYDRAULIC CYLINDERS

- Long recognized as the finest hydraulic cylinder made.
- No tie rods; ideal for long-stroke applications
- 12 bore sizes, 1" to 8"
- 11 mounting styles; many combination mountings available



Write for Bulletin 110

HYDRAULIC

New HANNIFIN "Space Saver" HYDRAULIC CYLINDERS

- Here is a square-type cylinder built to Hannifin's exacting standards
- Especially designed to meet the needs of machine tool builders

Write for Bulletin 111

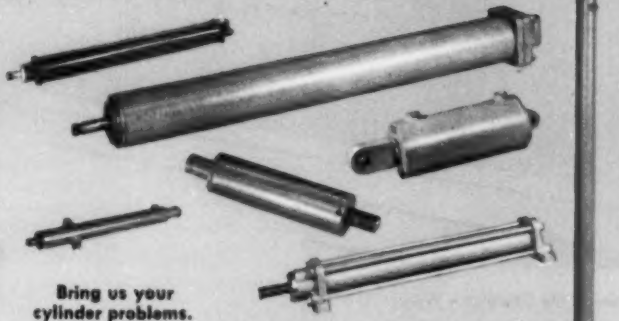
Series SS—9 Bore Sizes, 1½" to 6" Four popular mounting styles, rugged construction, for pressures to 2,000 p.s.i.

Type U—Pressures to 1000 P.S.I. 1", 1¼", 1½" Bores—Ideal for jig and fixture work.
Write for Bulletin 112

CYLINDERS

HANNIFIN "CUSTOM" HYDRAULIC CYLINDERS

- Built in quantity for use on customers' products
- Specially designed for each application
- Often the most economical way to buy hydraulic cylinders



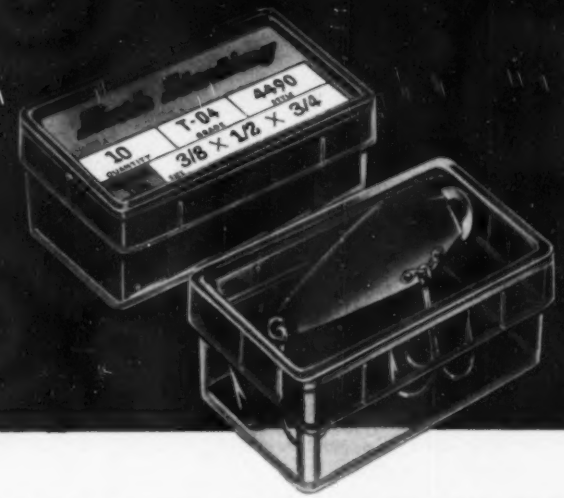
Bring us your cylinder problems.

HANNIFIN

Hannifin Corporation, 1117 S. Kilbourn Ave., Chicago 24, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

what has a fishing plug to do

with FIRTHITE STANDARD TIPS



R-284

When a good fisherman buys a quality plug, it is usually contained in a plastic case so that he can easily store, identify, and protect the beauty. The same packaging technique has just been adopted by Firth Sterling, Inc. for its high quality Standard Carbide Tips. Now Firthite Tips are being delivered to you in plastic containers specifically designed for ease in handling, convenience in stocking, simplicity in identifying, and protection in storing.

FROM STOCK BINS TO YOU

This and other innovations in modern packaging are just a part of a new merchandising program by Firth Sterling which is centered on the creation of an entirely new Central Commodity Store Room for more efficient service to you.

Firth Sterling INC

OFFICES* AND WAREHOUSES: HARTFORD NEW YORK* DETROIT CLEVELAND DAYTON* PITTSBURGH* CHICAGO BIRMINGHAM* LOS ANGELES PHILADELPHIA*

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

NEW

NEW from SKF

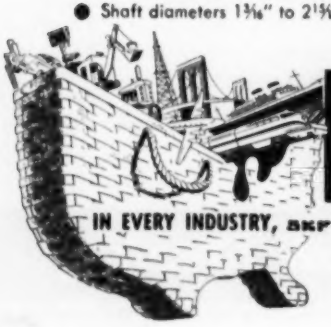
the HESS-BRIGHT "SY" UNIT PILLOW BLOCK

A new Unit Pillow Block, designed by SKF to meet tomorrow's needs of modern industry.

Here are the design features:

- SKF Red Seal, made of DuPont Fairprene, retains lubricant. Wiping action of the seal against the inner ring is practically frictionless.
- Rotating flingers exclude dirt.
- Set screws for ease of installation.
- Spherical outer ring compensates for initial misalignment.
- Alemite fitting for re-lubrication.
- Interchangeability with existing installations made possible by bolt hole spacing and center height features.
- Shaft diameters 1 3/16" to 2 15/16".

Detailed illustration of rotating flinger and RED SEAL—the extremely light tension contact seal.

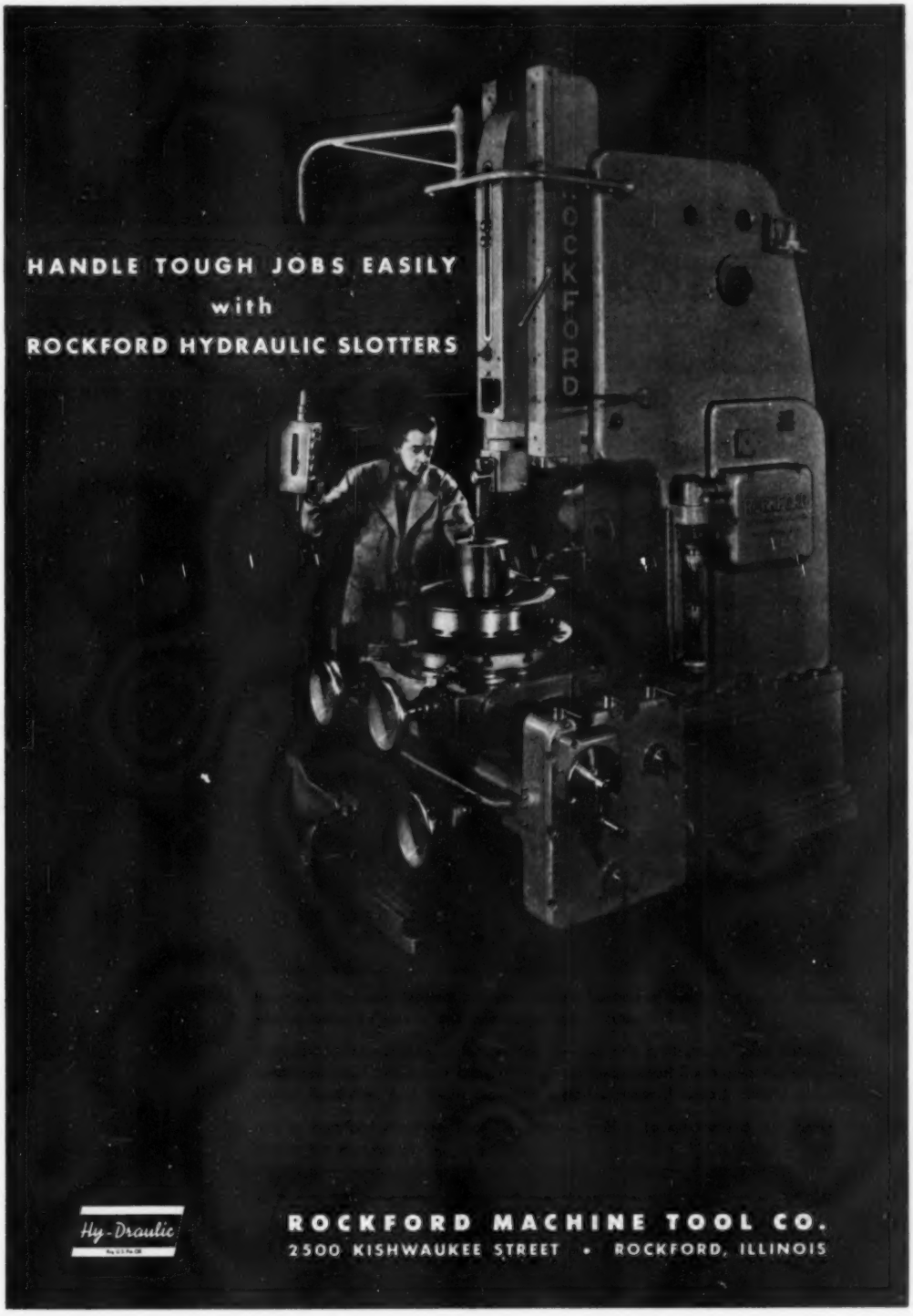


SKF
BALL AND ROLLER BEARINGS

IN EVERY INDUSTRY, SKF Puts The Right Bearing In The Right Place

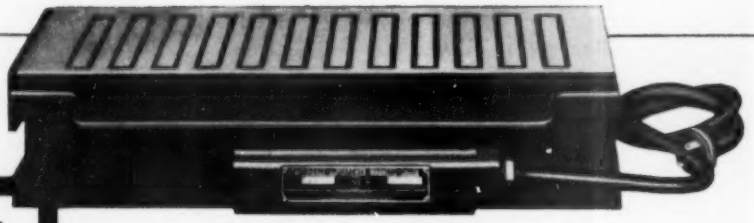
From now on, the name to remember in Unit Pillow Blocks is HESS-BRIGHT "SY"—manufactured in our plants, to the same high quality standards as all SKF products. Ask your SKF Distributor to show you the HESS-BRIGHT "SY"; or write SKF direct for complete information on this *newest* Unit Pillow Block.

SKF INDUSTRIES, INC., Phila. 32, Pa.—*manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.* 7323-A


HANDLE TOUGH JOBS EASILY
with
ROCKFORD HYDRAULIC SLOTTERS
ROCKFORD
Hy-Draulic
ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

Pounds Stronger ...Inches Smaller

TAFT-PEIRCE *SUPERPOWER* MAGNETIC CHUCKS



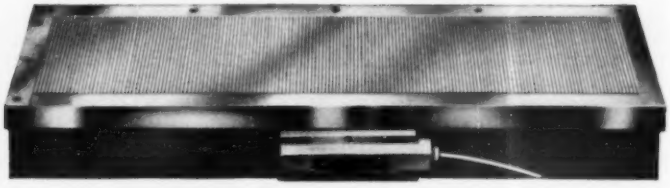
Standard Magnetic Chucks

T-P SUPERPOWER RECTANGULAR CHUCKS

provide pull right to edges of face plate. Thus pack *more* power in less space . . . to increase versatility, speed, and safety of setups. New Superpower Chuck with longitudinal pole pieces, at right, is most versatile yet devised. Handles both large and small work with equal ease.

T-P SUPERPOWER ROTARY CHUCKS

for rotating spindles. Provide greater work range and efficiency with their greater holding power and compactness. Available in standard sizes. Also with fine mesh face plate for small pieces.



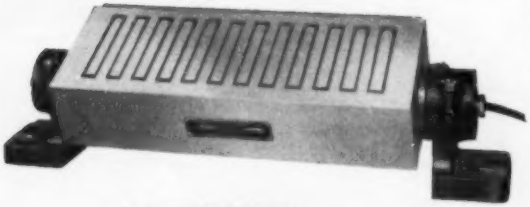
T-P SUPERPOWER FINE MESH CHUCKS

secure extremely small or thin sections formerly found impractical for magnetic chucking. Furnished in standard or special sizes.

Adjustable Magnetic Chucks

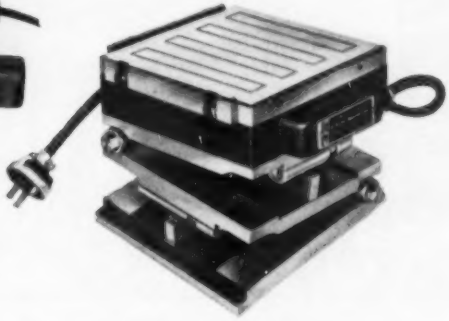
T-P SUPERPOWER DUPLEX BASE CHUCK

Saves time in grinding or machining angle work. Swivels 90° on either side of horizontal. Tilts to 14°. Clamps rigidly in any position. Available in standard sizes.



T-P SUPERPOWER SWIVEL BASE CHUCK

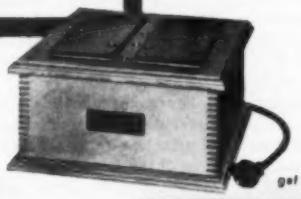
Swivels 90° on either side of horizontal. Clamps rigidly at any angle. Mounts directly on face plate of other chuck, or bolts permanently to table. Available in standard sizes.



T-P SUPERPOWER SINE ANGLE CHUCK

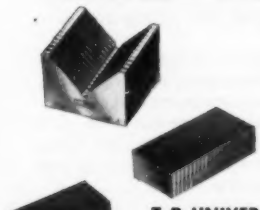
Speeds positioning of tricky angle grinding jobs. Gage blocks placed between roll and base plate assure high precision of compound angle setups.

Magnetic Chuck Accessories



T-P DEMAGNETIZER

Eliminates all trace of residual magnetism quickly, dependably. Standard in either 110 or 220 volts, 60 cycle. 440 or 550 volts on special order.



T-P UNIVERSAL MAGNETIC PARALLELS AND V-BLOCKS—Effective on any style or make of face plate. Available in stock sizes. Special sizes made to order.

For the complete story on these items and many more, get your copy of the New Taft-Peirce Handbook, just off the press.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY

WOONSOCKET, RHODE ISLAND

A Program for 30 million new Americans

LISTEN to the voices of 30 million new Americans. They are answering the pessimists who say we are threatened with depression because we can't keep our farms and factories busy.

Let these pessimists read the future in the census returns. There is a tremendous upsurge in our population. Last year nearly 4 million babies were born. By 1960 we shall total 170 million people--30 million more than when war ended in 1945. This adds to our domestic market more people than there are in Canada and Australia combined.

Providing for these 30 million new Americans can keep our production machinery going at capacity. They call for new hospitals, schools and churches. Larger families need bigger houses to replace post-war houses that are too small now. More and bigger families need improved home equipment and more new automobiles. In short, to maintain and improve living standards for our children, we must work harder than ever before. To supply the needs of our 1960 population, including adequate national defense, it is estimated that the productivity of the individual worker must increase at least 30%, with additional investment of over 200 billion dollars in capital facilities.

There should be no room in this picture for depression. But we must have economy in government, elimination of waste and extravagance and a reduction of taxes and public debt. If we encourage private incentive, thrift and investment, we can bring about the greatest advance in health, wealth and happiness that America has ever known.

QUALITY V YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

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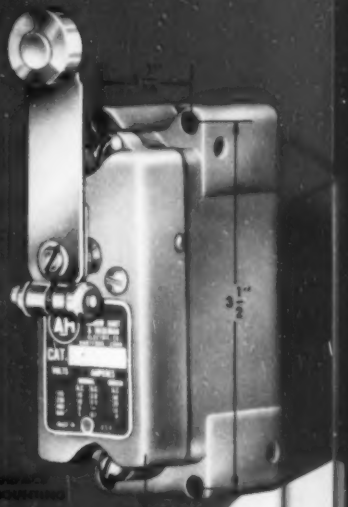
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

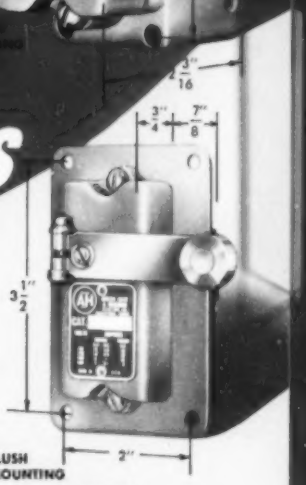
SNAP ACTION DESIGN . . . IN INDUSTRIAL CONTROL

PROVIDES DEPENDABLE PERFORMANCE



ARROW AH HART

Limit Switches



FLUSH MOUNTING

• SINGLE THROW, DOUBLE POLE TYPE • SNAP ACTION MAKE AND BREAK • INSTANT RESETTING FOR CLOCKWISE OR COUNTERCLOCKWISE LEVER ACTION • LEVER ADJUSTABLE TO ANY POSITION ON ITS AXIS — FULL 360° RANGE • A VARIETY OF LEVER LENGTHS and ROLLER TYPES AND SIZES AVAILABLE ON SPECIAL ORDER • ALL-PURPOSE, CAST ENCLOSURE — CONSIDERED OIL TIGHT and WEATHERPROOF • FLUSH OR SURFACE MOUNTING • CHOICE OF 3 CONTACT BLOCKS — N.O.-N.C., N.O. and N.C. • RATED 600 VOLTS MAXIMUM

One of the most commonly used of all pilot devices, limit switches are an indispensable part of practically every machine tool and other electrical installation requiring that movement be stopped or changed in direction automatically.

Because they are vital to the proper operation of a wide variety of machines, Arrow-Hart Limit Switches are designed and manufactured to provide the greatest possible electrical and mechanical versatility, dependability and high performance. The snap-action mechanism makes or breaks contact at the correct speed regardless of the speed of travel of the actuating lever. Mounting to meet the requirements of practically any installation can easily be accomplished. The sturdy, cast enclosure with gasket provides ample protection against oil, dust, dirt and other break-down materials.

Key to high output and increased profit is dependable performance — and Arrow-Hart Limit Switches are basic for dependability. Send now for complete information stating your installation requirements. Write to: 103 HAWTHORN STREET, HARTFORD 6, CONN.

	AMPERES		
	Normal		Inrush
VOLTS	A.C.	D.C.	A.C.
115	15	2.0	40
230	10	0.5	20
460	6	—	10
600	5	0.1	8

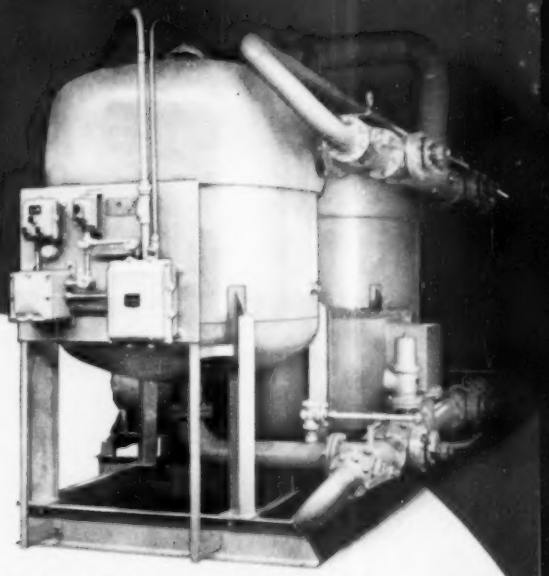
BUY WITH CONFIDENCE • PROFIT BY PERFORMANCE

THE ARROW-HART & HEGEMAN ELECTRIC CO., HARTFORD 6, CONN., U. S. A.

A LEADING MANUFACTURER OF MACHINERY USED IN

Hazardous Locations

SELECTS ARROW AH HART



EXPLO-SAFE

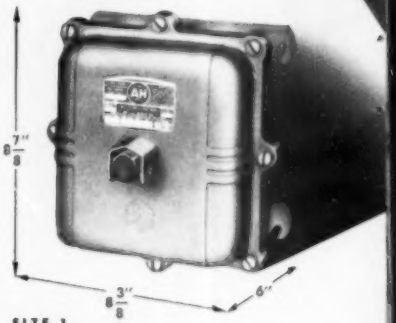
TYPE "RA" RIGHT ANGLE EXPLOSIONPROOF MOTOR CONTROLS

FOR COMPLETE PROTECTION, ADDED DEPENDABILITY AND PEAK PERFORMANCE — ALL IN A CONTROL JUST ⅓ THE SIZE AND WEIGHT OF ANY OTHER ON THE MARKET

The C. M. KEMP MFG. CO. — specializing exclusively in the design and manufacture of industrial gas machinery — is, naturally, well aware of the importance of selecting only **safe, dependable** motor controls of fine quality for equipment to be used in hazardous locations.

For this reason, Arrow-Hart EXPLO-SAFE was the logical choice for the Kemp Dual Tower Adsorptive Dryer shown above. Used for instrument air drying in a large southwestern chemical plant, it is equipped with an Arrow-Hart Size 1 Starter, a Size 3 Contactor and an explosionproof Push Button Station. This installation provides convenient control with complete protection and the **greatly reduced size** of the EXPLO-SAFE units permits mounting on an unusually compact panel with plenty of room left over for straight-thru wiring connections enclosed in a heavy conduit.

Like all A-H Magnetic Motor Controls, EXPLO-SAFE features the exclusive Arrow-Hart RIGHT ANGLE Operating Mechanism. This first real advance in motor control design in over 20 years makes it possible to bring full safety plus new standards of performance and long-lived dependability to every hazardous and exposed installation.



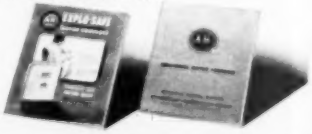
SIZE 1
NEMA TYPE VII

A COMPLETE LINE OF EXPLO-SAFE STARTERS AND CONTACTORS IN SIZES 00 AND 0 THROUGH 4 WITH ALL AUXILIARY EQUIPMENT*

For Full Information On

- **EXPLO-SAFE CONTROLS** for hazardous and exposed locations, send for your copy of the EXPLO-SAFE Bulletin.
- **ARROW-HART "RA" CONTROLS** for every motor control requirement, send for the complete new Arrow-Hart catalog, INDUSTRIAL MOTOR CONTROLS. Just fill in and mail the attached coupon.

*Approved by Underwriters' Laboratories. NEMA VII, IX Sizes 0 thru 3



ARROW AH HART

THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 HAWTHORN STREET, HARTFORD 6, CONNECTICUT

Please send me the following bulletins:

☐ LIMIT SWITCHES ☐ A-H PUSH BUTTON STATIONS
☐ EXPLO-SAFE Motor Control ☐ A-H MOTOR CONTROL Catalog
☐ A-H MULTI-SPEED and REVERSING CONTROLS

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CITY_____ ZONE_____ STATE_____

ARROW-HART

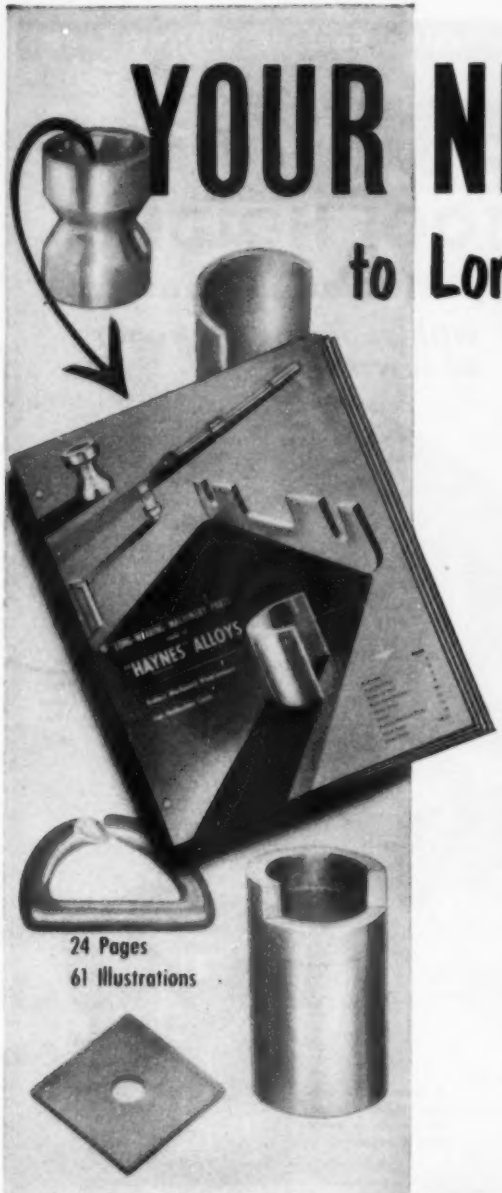
INDUSTRIAL CONTROL DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 HAWTHORN STREET, HARTFORD 6, CONNECTICUT, U.S.A.

Branches in: ATLANTA, BOSTON, BUFFALO, CHARLOTTE, CHICAGO, CINCINNATI, CLEVELAND, DALLAS, DENVER, DETROIT, INDIANAPOLIS, KANSAS CITY, LOS ANGELES, MILWAUKEE, MINNEAPOLIS, NEW YORK, PHILADELPHIA, PITTSBURGH, ST. LOUIS, SAN FRANCISCO, SEATTLE, SYRACUSE. In Canada: Arrow-Hart & Hegeman (Canada) Ltd., Mt. Dennis, Toronto.

Printed in U.S.A.

YOUR NEW GUIDE to Longer Machine Life



24 Pages
61 Illustrations

You may find in this booklet a part that you need to cure a continual maintenance headache. It describes a few of the thousands of machinery parts made of HAYNES alloys that have been used under difficult service conditions to assure long, satisfactory machine operation. Many of these parts have made possible large savings in down time and maintenance for countless manufacturers.

There are 19 different HAYNES alloys from which machinery parts can be made. Each alloy is specially designed to combat certain severe conditions of heat, corrosion, or wear.

All of the alloys can be obtained as castings; many as hot-rolled sheet and bars, stampings, forgings, and composite welded or brazed parts. They can be furnished ready for use—ground to the exact size and finish you want.

If you would like us to send you a copy of this booklet describing HAYNES *alloy machinery parts, just fill out the coupon below and mail it to us.*

The terms, "Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

HAYNES Trade-Mark *Alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
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USE THIS HANDY COUPON

Haynes Stellite Company, 732 S. Lindsay Street, Kokomo, Ind.
Please send me, without obligation, a copy of the new booklet, "HAYNES Alloy Machinery Parts."

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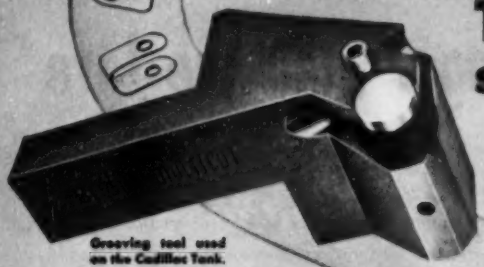
Specialists in Designing and Producing Carbide Cutting Tools

WESSON BAND TYPE TOOL HOLDERS

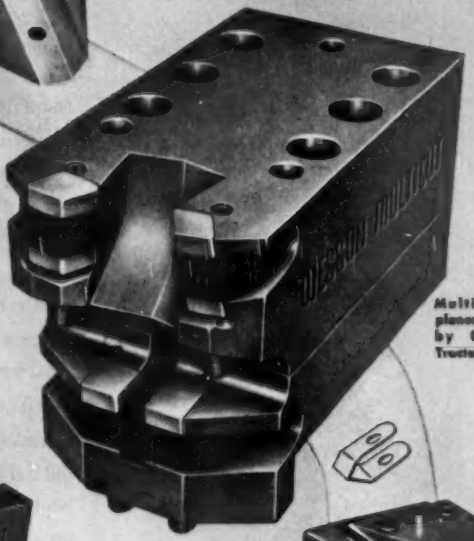
Special and Standard

with replaceable bands at low cost.

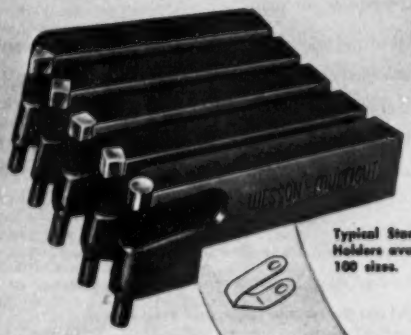


Grooving tool used on the Cadillac Tank.

ALL THE WEAR ON THE BAND MEANS EXTRA ECONOMY, EXTRA EFFICIENCY, HOWEVER SIMPLE OR COMPLICATED YOUR TOOL HOLDER PROBLEM!



Multiple insert planer tool used by Caterpillar Tractor.



Typical Standard Wesson Tool Holders available in 10 styles, 100 sizes.

2 insert tool for turning Ford-Lincoln rear axle shaft on a Bullard Man-au-trol.

WESSON
Carbide Cutting Tools

First choice when tough metals are to be cut—
for special or standard purposes—
for single or multiple set-ups.

WESSON COMPANY 1220 Woodward Heights Boulevard
FERNDALE (DETROIT 20) MICHIGAN
Affiliated with WESSON METAL CORPORATION, Lexington 34, Kentucky

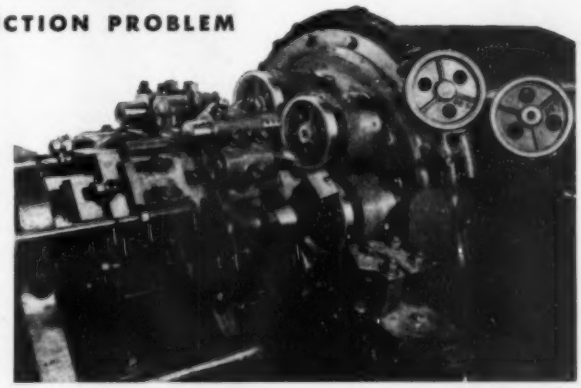
ASK **BAIRD** ABOUT IT!

TYPICAL OF THE EXTRA VALUES YOU GET WHEN YOU BRING A PRODUCTION PROBLEM TO BAIRD . . .

Year-in and year-out, in many automobile and other headlined production plants, Baird's No. 76-H Automatic Chucking Machine has proved itself to be one of the best production units of its kind. It's easy to operate and service; has unusual versatility in tooling, operations, speeds; and it cuts costs with quality control.

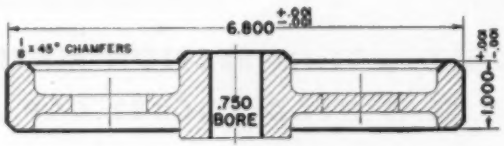
But the pay-off comes when Baird engineers adapt this 6-spindle unit to your specific tooling and production requirements.

For example, gear blanks (drawing below) are turned completely in one operation as shown. Material: High tension iron-hardness 85-90 Rockwell B scale. Production: 65 seconds each, 55 pieces per hour.

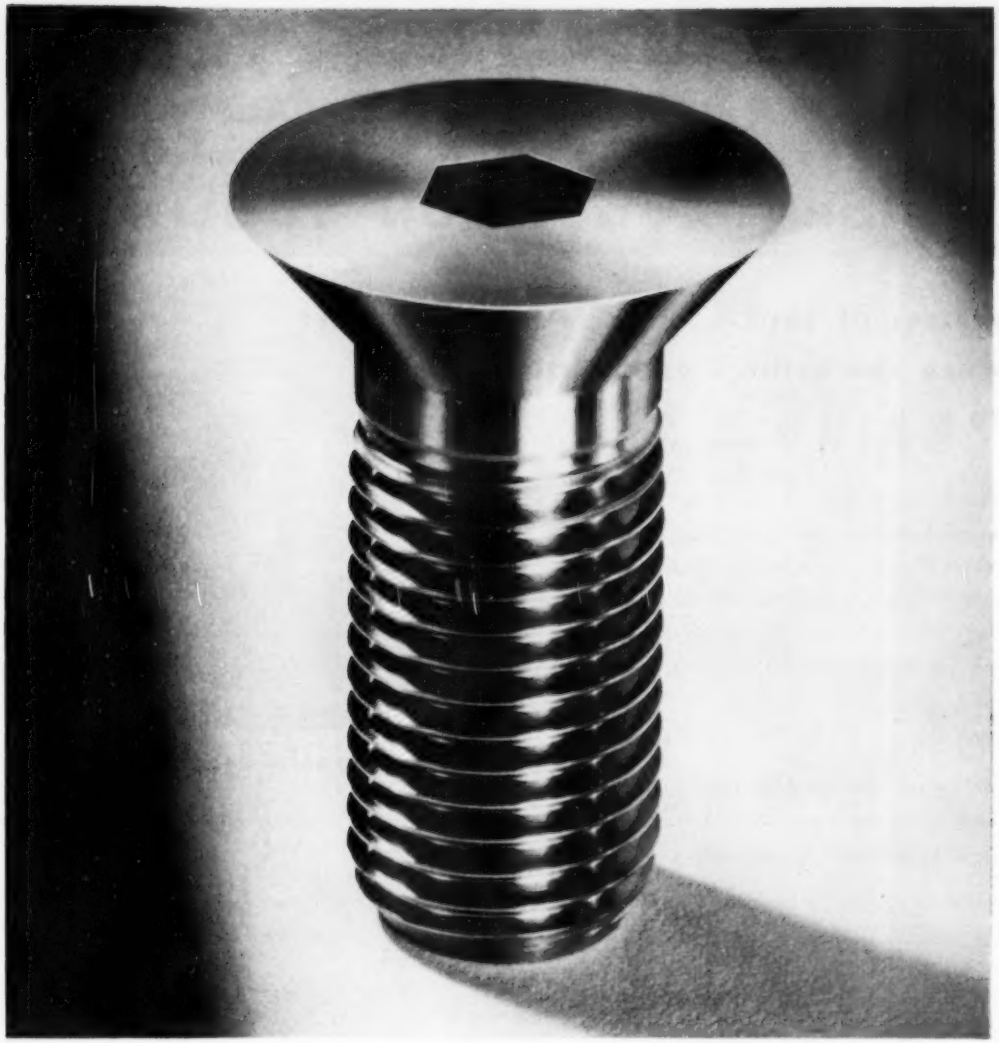


BAIRD No. 76H AUTOMATIC CHUCKING MACHINE

Of course we're busy. But not too busy to try and solve a problem for a new or old customer. Ask Baird about it!



the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT



For assembling THIN-SECTION MATERIALS
UNBRAKO FLAT HEAD SOCKET CAP SCREWS

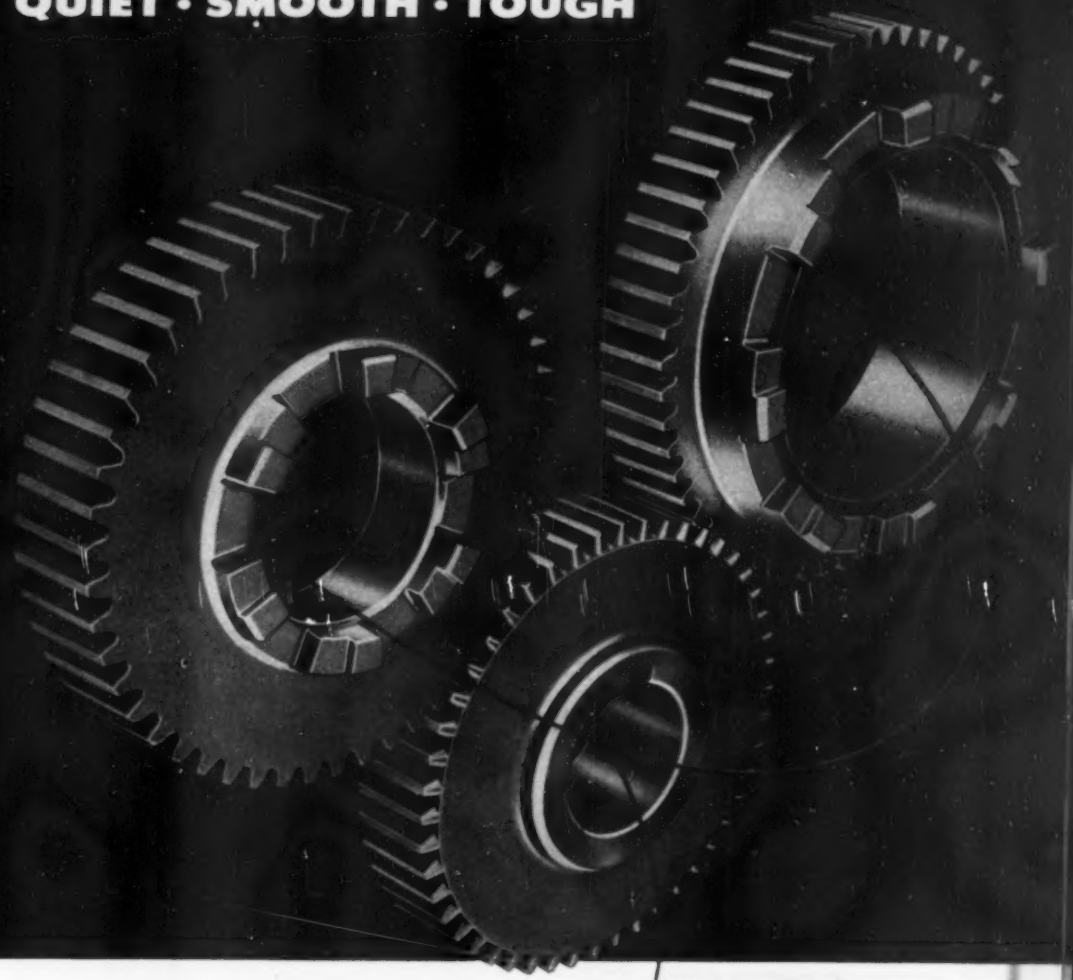
Precision made to Class 3 fit, these UNBRAKO screws have maximum head contact, flush surface assembly, non-slip internal wrenching, high shear and tensile strength. Write for descriptive literature. STANDARD PRESSED STEEL Co., Jenkintown 1, Pennsylvania.

Standard sizes, #4 to $\frac{3}{4}$" inclusive, are available from your UNBRAKO distributor's stocks. Ask him about deliveries, you'll like what you hear.

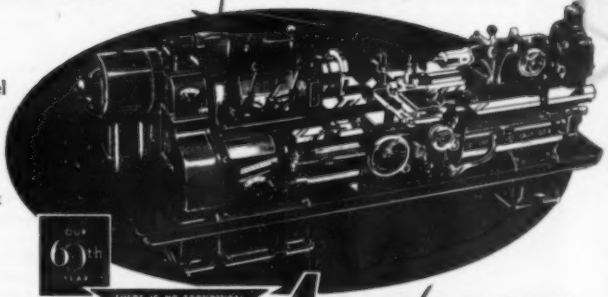
sps JENKINTOWN, PENNSYLVANIA

UNBRAKO® SOCKET SCREW DIVISION CAP SCREWS • SET SCREWS • SHOULDER SCREWS • DOWEL PINS • PRESSURE PLUGS

QUIET • SMOOTH • TOUGH



When you case-harden and precision-grind an alloy steel headstock gear the way AXELSON does it, you get one that not only operates smoothly—it stays on the job, offering high resistance to wear, to shock and to surface pitting. So it is throughout all AXELSON lathes. Quality built, they deliver dependable accurate work under the most difficult operating conditions.



OUR 60th YEAR

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON Lathes

CHOSEN FIRST . . . TO LAST

HEAVY DUTY ENGINE LATHES • TOOL ROOM LATHES • GAP BED LATHES

AXELSON MANUFACTURING CO. • LOS ANGELES 58 • NEW YORK 7 • ST. LOUIS 16

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production begins with

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It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

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Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
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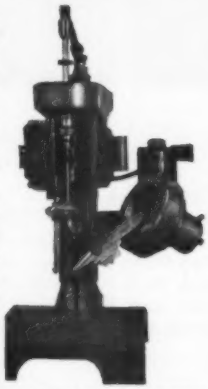
What's Wrong With This Picture?

THAT'S EASY There's NO DETROIT POWER SCREWDRIVER!



• Now—more than ever—speed in production is the order of the day—and D. P. S. Power Screwdrivers provide a wonderful contribution to present-day industrial needs . . . They are a "must" wherever the program calls for production assembling . . . They afford a tremendous gain over obsolete, slow hand methods. Detroit Power Screwdrivers will drive screws—any kind of screws—as fast as one a second.

• Get our Catalog NOW, describing POWER SCREWDRIVERS, MOTORIZED HOPPER UNITS, NUT DRIVERS and SPECIAL ASSEMBLING MACHINES. Write today. Also send sample assembly for production estimate.

DETROIT POWER SCREWDRIVER CO.
2797 W. FORT ST. DETROIT 16, MICHIGAN

New FEDERAL
Smooth-Air Clutch
and Electro-Pneumatic
Controls give
JET SPEED TO PRESSWORK!
These new Federals give "jet speed" to presswork. They are the perfect answer to faster production. With the new Smooth-Air Clutch and Electro-Pneumatic Controls, speeds may be increased safely; without damage to work, without sacrificing precision, and with no more than normal wear, thanks to balanced Federal construction. Operation is simpler—less fatiguing. May be "inched", single tripped, or operated continuously. Sizes 6 to 80 tons. Prompt delivery on all models including standard and dial feeds. Write for catalog.
FEDERAL
PRESS CO
ELKHART, IND

When all eyes can read the size

Assembly moves faster

good judgment calls for
PARKER-KALON®
when good design calls for
SOCKET SCREWS

Your INDUSTRIAL SUPPLY DISTRIBUTOR—*your local source for P-K Socket Screws—works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

Some sharp-eyed mechanics are expert at estimating the size of a plain head cap screw. But *most* assembly workers, and especially learners, need the screw that puts size beyond question . . . *the P-K Size-Mark Socket Head Cap Screw.*

The size is clearly incised on the head, can be seen at a glance. Saves time and wasted screws when sizes get mixed up, prevents errors and spoiled work. It's a good sales feature, too, because installation and repair work on your product is simpler and easier.

Only P-K offers both Size-Mark and Gear Grip in Socket Head Cap Screws. Ask for samples. See how they save time and trouble all along the line. Parker-Kalon Corporation, 200 Varick Street, New York 14.

SIZE-MARKED CAP SCREWS • GROUND THREAD SET SCREWS • FLAT HEAD CAP SCREWS • STRIPPER BOLTS • PIPE PLUGS • HEX KEYS

IN VAPOR DEGREASING

WHEN SO MUCH

DEPENDS ON A QUALITY SOLVENT

IT PAYS TO SPECIFY

SPEEDY, DEPENDABLE...

"TRICLENE" D Trichlorethylene is the result of over 20 years of research and practical experience in the degreasing field. Made under carefully controlled conditions by the pioneer manufacturer of degreasing solvents in the U. S., each shipment of "Triclene" D is carefully pretested for stability and purity... must meet test standards higher than those established by military and federal specifications (MIL-7003 and O-T-634). Yet "Triclene" D costs no more than other leading brands of degreasing solvents.

"Triclene" D is available nationally in 55 gallon drums and tank cars of various sizes. Distribution points in over 100 principal cities are ready to serve you with prompt deliveries. And trained Du Pont technical representatives with broad experience in the field will be happy to work closely with you in keeping your degreasing installations operating at peak efficiency.

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Send for your copy of "Vapor Degreasing with Du Pont Non-Flammable Solvents." It shows you how and where "Triclene" D can be used to save time and cut costs in metal cleaning.

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Electrochemicals Dept., Wilmington 98, Delaware

Please send me detailed information on Vapor Degreasing: applications, advantages, equipment used . . . and more facts on Du Pont "Triclene" D. We are interested in cleaning____products.

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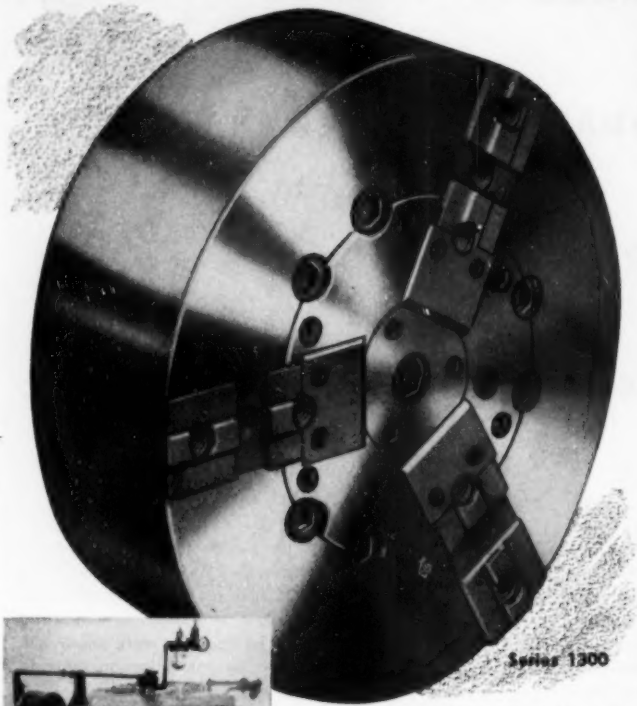
DU PONT REG. U. S. PAT. OFF. 150th Anniversary

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

SKINNER CHUCKS HAVE POWER TO PUSH PRODUCTION!



Write for catalog giving complete details on the Skinner line of power and manually operated chucks. And ask about new movie "Chucks and Their Uses" — available for free showings.

SKINNER CHUCKS

THE CREST OF QUALITY

THE SKINNER CHUCK CO.

343 Church Street, New Britain Connecticut

The Skinner line of power chucks and power chucking equipment has the strength, rigidity and design features so essential for today's production needs. Chucks are available from 6" to 21" with forged steel bodies, and with either 2 or 3 adjustable or non-adjustable jaws. Exclusive sliding wedge construction grips internal or external work positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates the draw bar. Skinner double acting rotating and non-rotating air cylinders are available for all sizes of Skinner power chucks, and for actuating all types of holding fixtures and tailstocks. Other Skinner accessories include hand operating valves —complete air unit including regulating valve, pressure gage and lubricator— filters — soft blank top jaws; draw bars —draw tubes, etc.

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EYE BOLTS

by an exclusive method

Among Pawtucket's many specialty products, these lower-cost eye bolts or "swing" bolts are the leaders in this field. Pawtucket's exclusive production method keeps cost low, dimensional accuracy unusually high and strength above standard.

Pawtucket eye bolts are made in standard sizes ¼" and larger, or to your specifications. In any size, you can depend on a uniform Class 3 fit.

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THE BOLT MEN

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327 Pine Street Pawtucket, R. I.

THE PLACE TO SOLVE YOUR BOLT PROBLEMS

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HYDRAULIC POWER becomes *Fire Power*

QUICKLY... EFFICIENTLY... ECONOMICALLY

with W-S ORDNANCE PRESSES

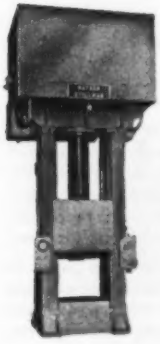
W-S Hydraulic Press flexibility of control is a natural for the precision required in shell forging manufacture. Combine this control with the economy of using only the press tonnage and stroke required and the exactly suitable speed and you have the answer to every pressing operation.

Reject percentage drops instantly, noise levels decrease, maintenance problems become insignificant when hydraulics take over your Ordnance press jobs. And hydraulics, of course, have been synonymous with Watson-Stillman for more than a century.

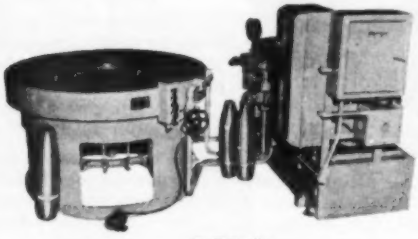
Write now specifying your type and size of shell for today's W-S Press recommendations . . . it's backed by 104 years of hydraulic experience.

Cold Extrusion Press

9-46-56

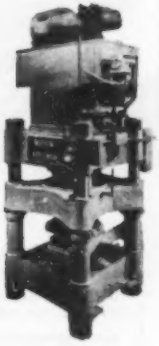


Shell Piercing Press



Shell Bunder

Shell Nosing Press



Billet Breaker

Branch Office:
228 N. La Salle, Chicago, Ill.

W-S HYDRAULIC

Manufactured in Canada by
Canadian-Vickers, Ltd., Montreal

Factory and Main Office:
HYDRAULIC MACHINERY DIVISION

WATSON-STILLMAN

ESTABLISHED 1848

ROSELLE, NEW JERSEY

W-S "Completeline" Hydraulics . . . The Shortest Distance From Production to Profits

Eliminate Work Transfers! Cut Set-up Time In Half!

KNIGHT NO. 50 FOR VERTICAL MILLING & PRECISION BORING

- Table feeds, 5/16" to 20" per minute plus rapid traverse in all directions.
- 16 spindle speeds, 40 to 2000 r.p.m.
- Boring feeds, infinitely variable, from .0005" to .010"

More production—faster—with less labor and lower cost! This accurate, versatile and rugged solid-base No. 50 is now doing the work of 2 or more machines in hundreds of busy plants!

The No. 50 incorporates every essential feature for handling an extremely wide range of difficult boring and vertical milling jobs with production-line speed and toolroom precision. Time-wasting work transfers are completely eliminated—set-up time is reduced to half or less!

A powerful 7½ H.P. all-gear motor provides power to spare for the toughest jobs. Convenient quick-action controls and full-vision work areas make operation easy and effortless.

ATTACH TO COMPANY LETTERHEAD

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Send details on No. 50 and other Knight milling machines.

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TITLE .....

☐ Send information on Knight 20" and 42" Power-Feed Rotary Tables.

Mail Coupon For Details

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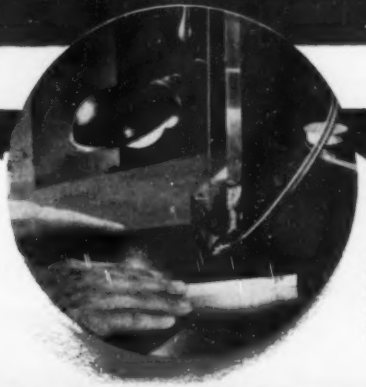
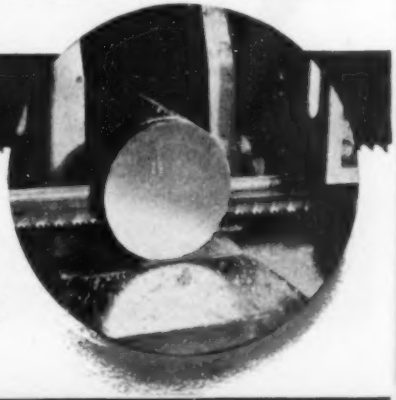
SIMONDS BAND SAWS



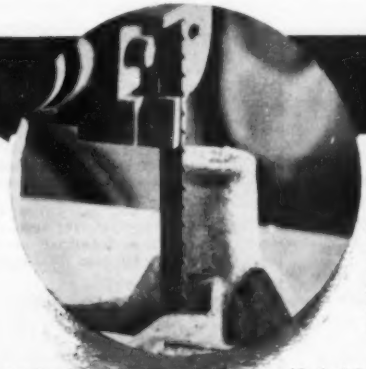
. . . for Contour Cutting

Made of tough, alloy steel that resists breaking, yet holds a keen cutting edge, Simonds Standard-Tooth Hard-Edge Band Saws in the narrower widths are outstanding favorites for contour work. That's why you'll find them so widely used in die-making and contour sawing of all kinds. Perfectly formed teeth, set with absolute evenness on both sides of the blade, insure smooth, accurate results and greater satisfaction



. . . for Horizontal Cutting

In the wider widths, these rugged, long-lasting Hard-Edge Blades are "tops" for use on horizontal machines, cutting off bars, tubing, angle iron, etc. Furnished either Regular Set or Wavy Set to handle the variety of cutting encountered in steel warehouses and general shop work. Hardy new 100' and approximately 300' coil containers insure factory perfect saw blades. Welded-to-length saws also supplied.



. . . for Non-Ferrous Cutting

Simonds Hard-Edge Skip-Tooth Band Saws are especially adapted for use on soft materials such as aluminum, magnesium, plastics, and hardwoods ...provide extra gullet capacity with maximum blade strength... are widely used in brass and aluminum foundries and plastic fabricating plants. Your Simonds Distributor will supply you with the right blade for your job.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago and San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que.
Southern Service Shop in Meridian, Miss. (formerly J. H. Miner Saw Mfg. Co.).
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.,
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ONE of AMERICA'S PRINCIPAL PRODUCERS of DRILL JIG BUSHINGS

ANNOUNCES ABC Precision Quality Piercing Punches

of premium steel, in two basic types:
Water Hardening Tool Steel — and High Speed Steel

The high quality performance of a punch depends upon:

(a) The Correct Quality Steel
(b) Precision Heat Treatment to gain full advantage of its properties
(c) Qualified Workmanship to insure dimensional accuracy

To these basic requirements must be added modern equipment to make possible production at reasonable prices. We have taken every possible step to produce an outstanding punch.

The water hardening tool steel we have selected is guaranteed to definite standards of grain size and depth of hardenability. For "shock absorber" action, the head and upper part of the shank are drawn back to 45-50 Rockwell C in such manner as to have a hardness gradient, rather than a sharp line of demarcation between different sections.

The underside of the head is ground slightly at the same time as the shank. This insures squareness of the underside of the head with the shank, and minimizes breakage during stripping.

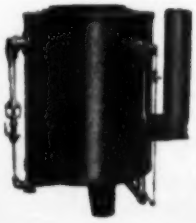
RELATED CONCENTRICITY — As a further example of the "built-in" qualities of A•B•C Precision Punches: the point is ground concentric with the body, within .0005" total indicator reading.

To achieve these A•B•C advantages, plus fine finish and smoothly blended radius to minimize stresses, we developed within our own organization special grinding fixtures and dressing equipment not found in outside markets. And, back of all this is our long record as one of the country's principal producers of premium quality drill jig bushings and fine precision parts for the automotive and other industries.

ACCURATE BUSHING COMPANY ABC

BUZZER *Gas* **FURNACES**

NO BLOWER or POWER NECESSARY



UP TO 1650° F. QUICKLY ATTAINABLE

Just connect to your gas supply and this BUZZER Atmospheric Pot Furnace is ready for operation. An innovation in design they are unbeatable for salt bath or lead hardening. Even heat, close control, high efficiency are only few of the many features. Available in many sizes.

Send today for the BUZZER catalog.

CHARLES A. HONES, INC.

"YANKEE" VISES

Give *Start-to-finish* work holding

Off the swivel base, and down for accurate marking.

Back on the swivel base, at the bench, for center punching.

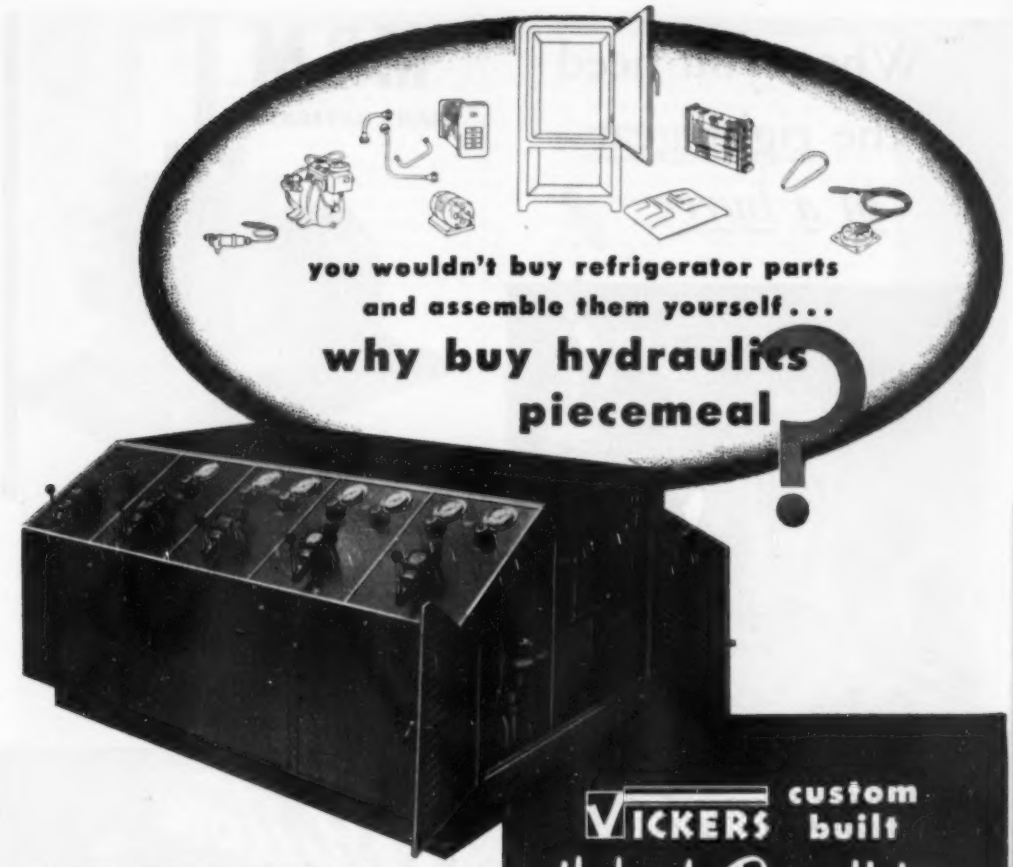
Lifted onto drill press, still accurately in position.

Held in same position but moved to milling machine.

Take a job through every step without a misstep . . . faster, easier . . . in a "Yankee" Vise. Work lined up accurately from bench to drill press, to milling machine and back to bench. Lifts off and on a swivel base at the bench. Vise squared on top, bottom, sides and front end for machine work. Easily made into handy, economical jig. Hardened steel block, V-grooved, provided with each "Yankee" Vise. Four sizes, with and without swivel base . . . 1½", 2", 2¾" and 4" jaw widths. Your industrial distributor carries the full line. **"Yankee" Tool Book FREE!**

NORTH BROS. MFG. CO.
Philadelphia 33, Pa.

"YANKEE" TOOLS NOW PART OF STANLEY
THE TOOL BOX OF THE WORLD



you wouldn't buy refrigerator parts
and assemble them yourself . . .

why buy hydraulics piecemeal

VICKERS custom built
Hydraulic Power Units

You *could* buy a motor, compressor, coils, valves, tubing and cabinet separately and put them together to make a refrigerator of a sort. But you wouldn't want the trouble and expense, and you wouldn't want to take the responsibility for successful operation. You would rather buy a complete refrigerator . . . get the manufacturer's know-how and have him take undivided responsibility.

Then, why buy hydraulics piecemeal when a Vickers Custom Built Hydraulic Power Unit offers so many more advantages? It is built to meet your individual requirements. All necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc. are in one self-contained "package". It includes all needed accessories such as oil filters, air cleaners, oil level gauges, fittings, etc. Hydraulic connections are grouped in a conveniently located manifold.

Simplified hydraulic design, improved appearance, and substantial savings in installation and maintenance costs are the result. A most important advantage to both machine builder and his customer is Vickers undivided responsibility for the entire hydraulic system. For further information ask for Catalog 5000.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

When you need the right gear *in a hurry*

It's one thing to get a gear cut exactly to your specifications . . . and another to get it *on time*. To be sure of satisfaction *both* ways, there's only one safe thing to do: specify Grant gears. For, whether you order by 'phone, telegraph or letter, Grant will have just the gear you want on its way in a matter of hours.

Next time a gear breakdown threatens a costly production tie-up, remember Grant's "in-the-pinch" service.

75th ANNIVERSARY

Grant FOR GEARS

GRANT GEAR WORKS, INC.
169 W. SECOND STREET
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M&M

GIANT KEYSEATERS

M & M Giant Keyseaters, built in a wide range of sizes, speedily and accurately cut internal keyways or splines in the bores of pulleys, gears, fly wheels or any other machine part. Special fixtures and cutters are available for unusual shaped keyways and taper work. Send us your problems today.

MITTS & MERRILL 68

104 Holden Street • SAGINAW, MICHIGAN

Whiton

INDEPENDENT LATHE CHUCKS

MULTI THRUST Feature

Gives Jaws "Steel Finger" Action

- Tighter Gripping
- More Rigidity
- Greater Accuracy
- Even Distribution of Pressure

Try it yourself. Pick up a piece of work in your fingers. That's ordinary holding. Now squeeze . . . that's Whiton Multi-Thrust "Steel Finger" action.

Work Holding Problems? Write Whiton
Ask for catalog, too.

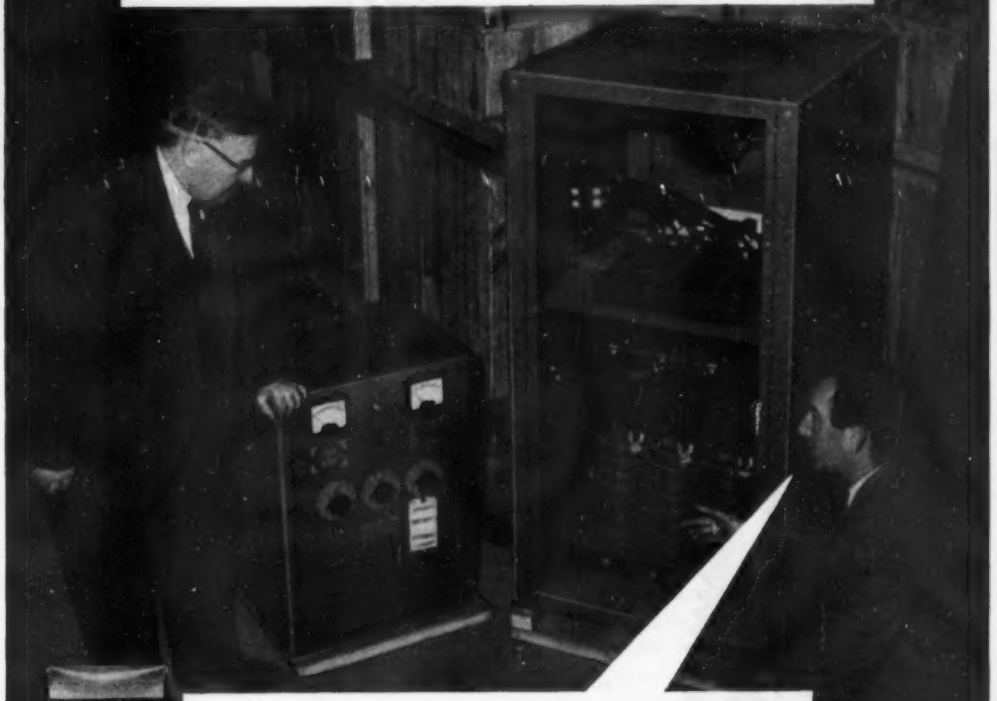
Makers of Fine Chucks • Steam Turbines
Centering Machines •

THE WHITON MACHINE COMPANY
NEW LONDON, CONN.

There's plenty of reserve capacity, more than enough for all your needs. And take a look at the acid and alkali resistant coating on these oversize transformers and selenium stacks—that's real assurance of dependable long life. But that isn't all. Those connections from the transformers to the selenium rectifiers are so flexible that floor vibrations can't possibly loosen the cell connectors. And for ventilating, the chimney effect produced by drawing clean cool air through the cabinet cuts the danger of overheating. These advantages are built into every H-VW-M rectifier—the ones you see in these crates ready to be shipped—and those in service all over the country. They're built to last for *years*.

Durable, dependable rectifiers are only one of the many results of H-VW-M's constant progress in electroplating development for more than eighty years. It's a continuous policy, best summed up in H-VW-M Platemanship . . . your working guarantee of the best that industry has to offer—not only in rectifiers—but in every phase of plating and polishing.

6529



PLATEMANSHIP

PLATEMANSHIP

this oversize rectifier transformer is typical of H·VW·M "extras"

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

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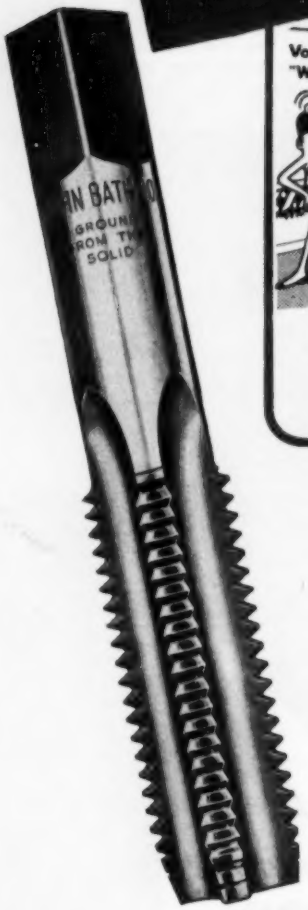
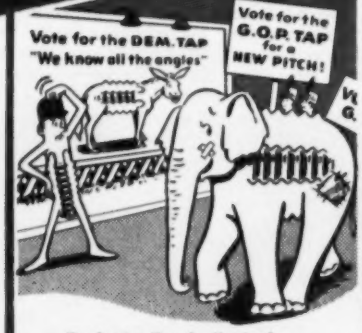
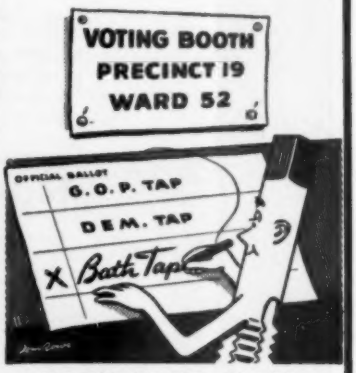
INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

TAP-ODDITIES





Production Pete is all mixed up
As election day draws near.
But—of one thing he is quite sure,
He's going to vote this year!



We need both "pitch" and "angle"
To get the best work done.
Pete picks a sure-fire winner
And—the country's favorite son!

Bath "ground from the solid" Taps have been a successful candidate on industry's ticket for many years . . . elected to serve again and again because of many outstanding qualities.

For instance . . no expense is spared to produce Bath Taps to accurate pitch diameter—one of the most important dimensions on the tap. Once determined, the tap can be duplicated to exact size for Bath customers at any time.

Another important feature . . . the rake angle of Bath Taps is accurately made to your specifications—and will be exactly the same on one tap or a hundred . . . on your first or any subsequent order.

Dependability is a quality much to be admired in public life . . . or in a product. At the John Bath Co., you can always rely on accuracy of design, uniformity of manufacture and rigid inspection. Buy Bath Taps for Better Threads!

INSIST ON BATH TAPS
—PROFIT BY THEIR
PLUS—PERFORMANCE

JOHN BATH CO. INC. · WORCESTER · MASS

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
22 Grafton St., Worcester, Mass.

Draftsmen work better, faster with this machine...

PHOTOS BY COURTESY OF THE UNIVERSAL DRAFTING MACHINE CORPORATION

By holding spindles absolutely rigid and keeping motion friction-free, Fafnir Ball Bearings contribute much to the vernier accuracy and effortless action of the Universal "Boardmaster". The ultimate results are more accurate sketches, layouts or detailing and "on the nose" template work in faster time . . . so important when good engineers and draftsmen are scarce.

At three pivot points, pairs of extra-light, compact single row, Fafnir Ball Bearings give finger touch ease of movement without a trace of play. At the "centralized control unit", a large diameter Fafnir Bearing is used together with paired, preloaded and pre-lubricated Fafnirs. Six of the seven Fafnir Bearings used are Plya-Seal Type, which prevent lubricant leakage, keep out contaminants, and are lubricated for life.

The faculty for providing custom-made types of bearings out of stock . . . from the most complete line in America . . . makes Fafnir the first source consulted by leading manufacturers. Maybe you can solve bearing problems this easy way. The Fafnir Bearing Company, New Britain, Conn.

Standard Radial Bearings

Wide Inner Ring Ball Bearings with Mechani-Seals

Plya-Seal Type Bearings

For Your Metal Surface Treatments
consider PARKER'S *background*

▼

over 37 years' experience • over 1500 customers

many MILLIONS of parts treated • PERFORMANCE PROVED

Research — a continuing, aggressive and expanding program, since our 1915 pioneering days — has maintained Parker leadership in the surface treatment of metals. Today, Parker products are more versatile, more efficient and more widely used around the world than ever before.

For you this means getting the benefit of Parker's rich background of practical experience, and of research facilities unequalled in this field. Address:

PARKER RUST PROOF COMPANY
2196 East Milwaukee, Detroit 11, Michigan

PROTECTED BY Bonderite QUALITY CORROSION RESISTANT

***BONDERITE**—corrosion resistant paint base . . . widely used on brand name refrigerators, ranges, autos, etc.

***Bonderite and Bonderlube**—aids in cold forming of metals . . . 90% of all seamless steel tubing is drawn with Bonderite . . . many ordnance items being manufactured with this aid.

***Parco Compound**—rust resistant . . . used on iron and steel articles, small and large, simple and complex.

***Parcolacs**—group of specialized products made up of various finishes for use after Parco Compound . . . includes wax base finishes, stains and rust preventive oils.

***Parco Lubrite**—wear resistant for friction surfaces . . . used to create a nonmetallic phosphate "break-in" coating on gears, cylinder walls, pistons, rings, shafts, valves and rods.

***Parco Prime**—corrosion resistant paint base for use on structural steel and custom fabricated articles too large to process by conventional methods . . . single coat, spray or brush applied, creates uniform prime coat on iron and steel.

***Parco Black**—corrosion resistant coating which provides a jet black finish on iron and steel parts in a single bath. Used on nails, nuts and bolts, tools, hardware.

Technical bulletins mailed upon request.

PARKER

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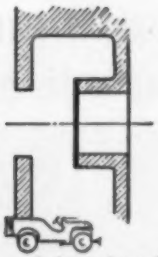
Automatic Recessing

the "Know-How" of grooving

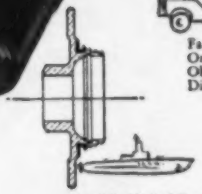
with SJ SCULLY-JONES

AUTOMATIC RECESSING TOOLS

They do these operations on standard drill presses, radial drills, turret lathes and chucking machines, as well as on special machines. A single recessing tool is easily adapted to do various operations or a combination of operations. Adjustments regulating location and depth of groove are simple, fast and accurate. Types "J" and "C" pilot in a fixture bushing. Type "R" pilots in, and stops on the work.



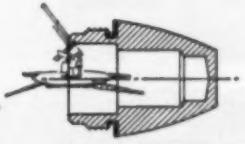
Facing An Internal Boss On Motor Castings Where Obstruction Usually Causes Difficulty.



Both Inside And Outside Clearance Grooves Cut In One Operation On Oil Tank Caps For Submarines.

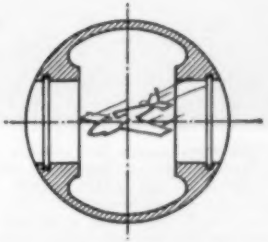
TYPICAL RECESSING-TOOL OPERATIONS

Formed Recesses Made In One Operation On Detonator Bushings Of Large Calibre Motorized Artillery Rifles.



Groove For Thread Clearance Cut On Anti-Aircraft Projectile With Automatic "Necking" Tool.

Casting Of Part For Army Tank On Which Two Recesses Are Made At One Time.



Snap-Ring Grooves Cut In Wrist Pin Hole Of Airplane Pistons.

Scully-Jones AND COMPANY

WRITE FOR BULLETIN No. 10-50
showing types, sizes, specifications and prices.

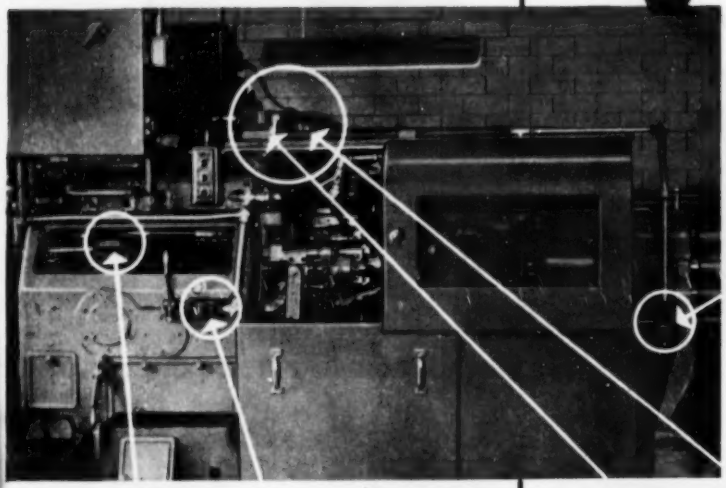
1902 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

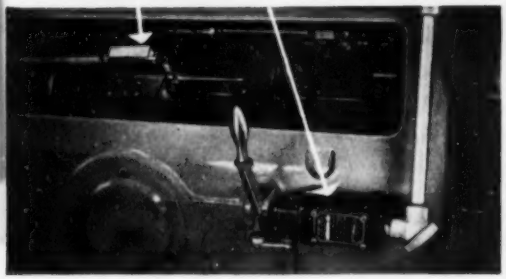
How one plant engineer used 5 MICRO Precision Switches to make a six-spindle screw machine best suited to his production needs!

Plant operating men have found hundreds of uses for MICRO precision switches on present plant equipment to make the operation of their machines best fitted to their production needs.

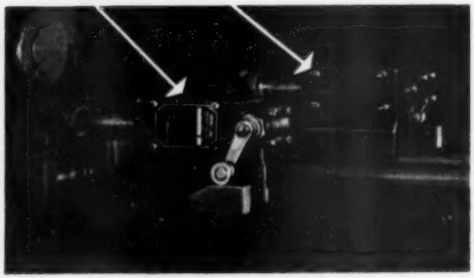
These illustrations show how one plant operating man used five MICRO precision switches to make the operation of a six-spindle screw machine more perfectly adapted to his specific needs.



MICRO "5ML1" limit switch (above) that is operated by the chuck closing shoe. This switch must be operated at the same time as the one on the hand closing lever or the machine will stop, thus preventing damage to the shoe and the chuck opening and closing mechanism.



The MICRO general purpose limit switch at upper left has a roller arm actuator. If a part that has been machined becomes jammed in the collet and is not ejected properly, this switch shuts off the motor before damage can occur.
A MICRO "1ML1" limit switch is operated by the hand starting lever as shown at lower right. If the collet is not fully closed, the machine will not start.



The MICRO "1ML1" heavy duty limit switches shown above operate when the shields on either side of the machine are slid open. This action operates one or the other switch which shuts off the power until the shield is reclosed. This adds to safety of the operator and keeps oil from splashing on the floor.

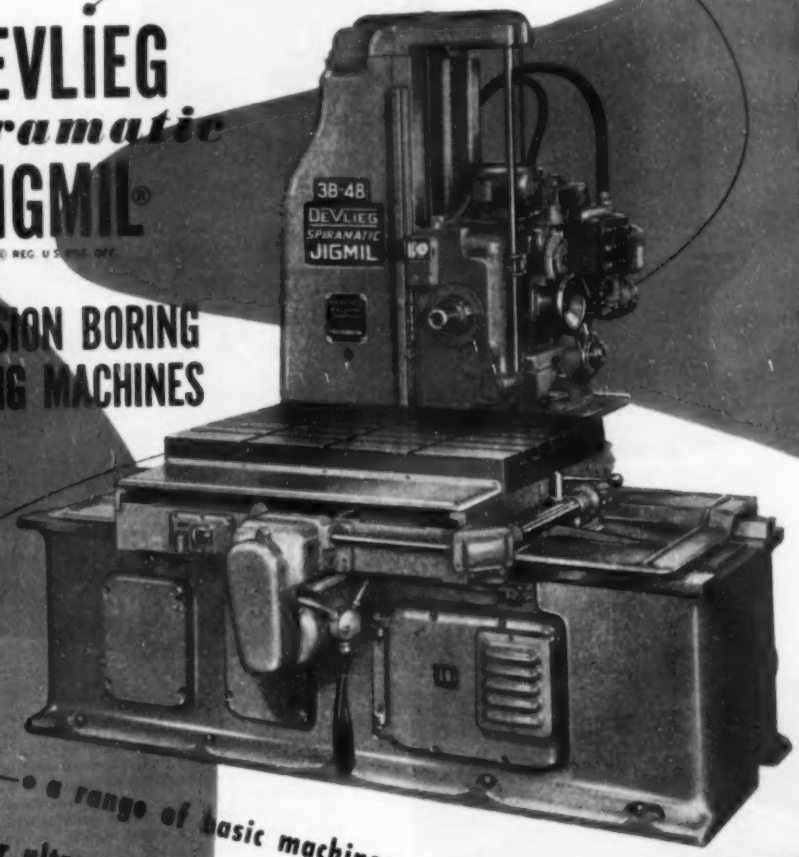
MICRO distributors are located in over a hundred key cities to supply just the right switch to meet your plant application need. Look for your nearest distributor in your classified telephone book under "Switches, Electric."

MICRO
MAKERS OF PRECISION SWITCHES
FREEPORT, ILLINOIS

A DIVISION OF
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

DEVLIEG
Spiramatic
JIGMIL®

® REG. U.S. PAT. OFF.



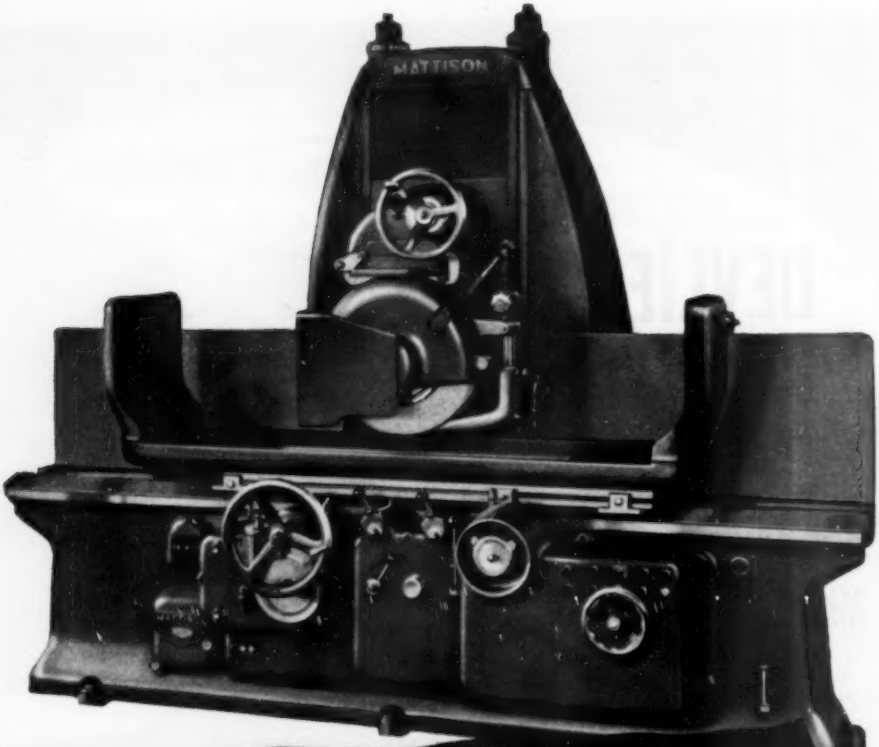
PRECISION BORING and MILLING MACHINES

• a range of basic machines for ultra precision boring and milling

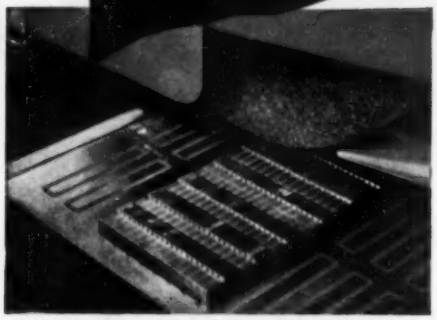
for the latest developments in precision boring equipment . . . consult—

DEVLIEG OF DETROIT

DEVLIEG MACHINE COMPANY • 459 FAIR AVE., FERNDALE, DETROIT 20, MICH.



HERE'S A CHANGE THAT INCREASED PRODUCTION FROM 30 PER HOUR TO 200 PER HOUR



Both sides of type-stamps are now ground 200 per hour on a Mattison Grinder. Previous production — 30 per hour.

● Because of the greater load and grinding area of their Mattison High Powered Precision Surface Grinder, Geo. T. Schmidt, Inc., Chicago, Illinois have been able to effect considerable savings in grinding time over their previous method. As an example — the type stamps shown in the picture above were formerly ground a few pieces at a time on a small grinder — 30 per hour. The Mattison Grinder they are now using provides larger table space and a larger grinding wheel together with the necessary power and stability to permit the grinding of more pieces per load at a production rate of 200 per hour. Similar results are obtained on other parts.

Mattison High Powered Precision Surface Grinders have the high power and rugged double-column construction for rapid stock removal and the precision necessary for high quality finish and accuracy to close limits.

This combination not only will enable you to step up production on small parts, but permits grinding large work which previously could not be handled. For further information send for free circular.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

For this Automobile Fan Shaft . . .

The right Republic Steel Saved

40% IN COST...

3 OPERATIONS...

3 INSPECTIONS...

AND 1 BIG HEADACHE

Here's another case where Republic Carbon-Corrected Bar Stock replaced a carburizing steel.

Before they switched to Republic Carbon-Corrected Steel Bar Stock for automobile fan shafts, Schwitzer-Cummins Company had been carburizing the steel shafts after machining. This ran up costs, created the headache of carburizing and inspecting, tempering and inspecting, cleaning and inspecting, and finally straightening warped shafts and inspecting.

The Schwitzer-Cummins metallurgist called on our Republic 3-Dimension Metallurgical team . . . the Field Metallurgist, backed up at home by the Laboratory and Mill Metallurgists. The decision was made to change over to Republic Carbon-Corrected AISI-C 1144 Bars. Now, induction hardening and inspection takes the place of the previous 8-step procedure. No warped shafts to straighten, and a better fan shaft that will last longer in your car or truck. Cost is reduced up to 40%.

The help our Republic 3-Dimension Metallurgical Service gave to Schwitzer-Cummins metallurgists is also available to you. It can help you make better products at lower cost. When shall we call?

REPUBLIC STEEL CORPORATION

Alloy Steel Division • Massillon, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, N. Y.

LAB · MILL · FIELD

3-DIMENSION Metallurgical Service

Republic COLD DRAWN ALLOY STEEL BARS

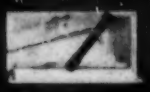
REPUBLIC STEEL

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Plates, Pipe, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

ARMOR-TUF

THE AMAZING NEW STEEL HARDENING COMPOUND

"ARMOR-TUF hardens tools and steel parts as easily as baking pie, and much more quickly."



Now used by leading steel processors and other manufacturers everywhere!

You can use milder, cheaper steels for many applications and machine them before hardening. The saving is two-fold: less expensive steels and lower machining costs. ARMOR-TUF gives low carbon steels the cutting and wearing properties of tool steels. You can harden the softest steels to a degree ordinarily obtainable only in high priced steels.

Service between sharpenings increased 10 times and more. Tools hardened with ARMOR-TUF hold their edges many times longer. The advantages: substantially reduces resharpening costs . . . saves on time lost changing dull tools . . . keeps tools in service . enables increased production as result of less frequent tool changing and sharpening.

As compared with the usual heat treating processes, the saving in time is great. Instead of hours, only minutes are needed. The entire hardening process takes less than ten minutes .

No CYANIDE, Absolutely — ARMOR-TUF is safe to use, contains no cyanide of any kind or other toxic ingredients.

ARMOR-TUF IS UNCONDITIONALLY GUARANTEED TO INCREASE THE LIFE OF TOOLS AT LEAST 300%, OR YOUR FULL PURCHASE PRICE WILL BE REFUNDED.

Armor-Tuf Laboratories, Inc.

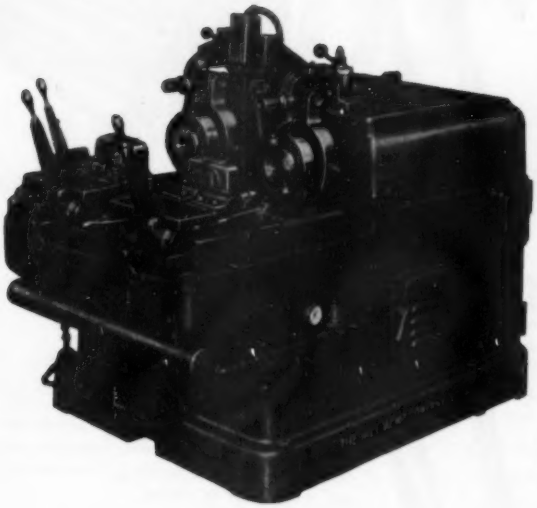
595 Fifth Avenue • New York 17, N. Y.

Another FIRST

FOR

ACME XL

THREADING MACHINES



Air operated Head now available . . .

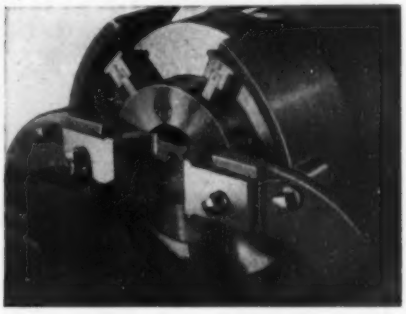
Acme Model XL Threading Machines can be equipped with a semi-automatic, air-operated head-opening and closing mechanism for rapid lock and release of dies to provide greater accuracy of thread length and reduce operator fatigue. A bleeder valve adjustment provides variable speed to this head tripping mechanism. Forward and return movement of the carriage effects the opening and closing of the die head.

This new device is an exclusive feature of ACME Model XL Threading Machines and is adaptable to both single and double spindle machines in the complete range of sizes offered.

HILL ACME TOOLS FOR INDUSTRY

ACME HOB TYPE 5 DIE HEAD

The problem of threading rectangular stock with an interrupted cut, is solved by the ACME HOB TYPE 5 die head. This special head insures three chasers always being in contact with the work. With the five die head illustrated, a guide is provided to compensate for the torque developed when threading rectangular stock. This adaptation of ACME Threading Equipment to difficult jobs, illustrates why the large percentage of pipe wrench manufacturers are using ACME Threading Machines today, replacing the obsolete thread milling method.



THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1207 W. 65th St., Cleveland 2, Ohio**

ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

Your best work
Your fastest work

WITH THESE

ACCURATE TAPS

Today's State of Emergency calls for a doubling of efforts to conserve. An important step in this direction is the use of REIFF & NESTOR Taps. Your best work, and fastest work, is accomplished by their application, as industry has discovered through the use of REIFF & NESTOR Taps for the past forty years.

Your machine set-ups will run longer because of the quality heat treating and accurately controlled grinding that puts L-I-F-E into our products.

Remember, your best work results only if your Taps are perfectly accurate. REIFF & NESTOR Taps assure you of this.

REIFF & NESTOR COMPANY

Tap Making Authorities

LYKENS • PENNSYLVANIA

for SMALL **JIG BORING**

PUT SMALL JOBS ON THIS **LINLEY MACHINE**

and save your larger machines for heavier work.

YOU'LL BE SURPRISED! at the extremely low first cost and the vitally important jobs that this little precision machine can do. It will pay you to get our accuracy information on this machine which has 6" x 10" table movement and 7" x 17½" table size.

Write TODAY for Full Information

LINLEY BROTHERS COMPANY

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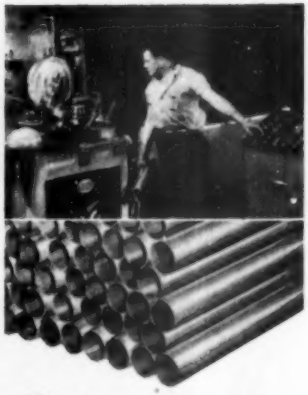


Thinking of making

PIPE OR TUBING?

In 1938, total U.S.A. production of electric-weld pipe and tubing was only 269,000 tons. But in that year, Yoder brought out a line of cold-roll-forming tube mills, equipped with their revolutionary new electric-resistance welder.

According to the latest available figures, U.S.A. production of electric welded pipe and tubing in 1950 was nearly 3,500,000 tons, a growth of 1300% in 12 short years.

Much of this growth was due to the advantages of the cold-forming, electric-weld process in general, and to the excellence of Yoder Tube mills in particular, because most such mills installed since 1938 have been built by Yoder.

With the new multiple cross-type welding transformer and other recent Yoder developments, Yoder mills now offer higher speeds and greater production than ever. If you have been thinking of making pipe or tubing, get the latest information on Yoder mills—yours for the asking.

THE YODER COMPANY

5519 Walworth Ave. • Cleveland 2, Ohio

Resistance Weld TUBE MILLS

ENGINEERING YODER MANUFACTURING

NEW CORROSION INHIBITOR
STOPS RUST
...CUTS COSTS

If you make—ship—or store metal parts that rust can damage...

HERE'S IMPORTANT NEWS

New Shell "VPI" is effective in even the most difficult cases of rust prevention—and it's easy to use, too. "VPI" is a volatile corrosion inhibitor which comes in both crystal and paper wrap form.

Whenever moisture is in air, "VPI" vaporizes and makes air noncorrosive. "VPI" is applied quickly... containers do not have to be airtight. Container costs are reduced. Handling costs are lower because there's no greasing and degreasing . . . no need for expensive rust-removal jobs after part is unpacked.

Your Shell Representative can give you more information about the "VPI" method of rust prevention. Call him today. Or write to nearest address listed below.

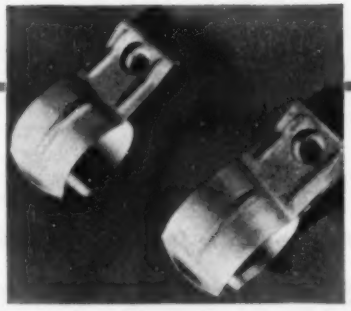
SHELL OIL COMPANY
50 West 50th Street, N. Y. 20, N. Y.
100 Bush Street, San Francisco 6, Calif.

SHELL®

VPI

(a volatile corrosion inhibitor)

stops air and moisture from making rust.



"VPI" can be used many ways. The photo at the left shows powder being blown into critical areas of aircraft engines to prevent corrosion during storage. Photo at right shows identical spring clips stored 3 weeks in an open box. The upper clip was first sprayed with 4% "VPI" solution. Note that the "VPI"-treated clip suffered none of the rusting which is apparent on the lower clip.

Ross Solenoid Operated, Pilot Controlled Valves

The reputation and performance of Ross "711" Series Valves are so outstanding that imitations are constantly being attempted. Through constant improvements, the "711" remains the leader and the envy of the trade. Here's why—

- ☆ *Dependable*—10 to 20 million maintenance-free cycles, and many more tens of millions of life-cycles, are not uncommon.
- ☆ *Speedy*—split second operation; oversized exhaust
- ☆ *Low current consumption*—inrush of 1.2 amps @ 110/60
- ☆ *Positive seal* — poppet construction; Hycar seats
- ☆ *Easy maintenance*—only a few moving parts; bodies interchangeable without removing piping
- ☆ *Many modifications*—vacuum, air, and liquid service; various pressures; AC or DC solenoids; momentary contact

Write for full information on the Ross "711" Series

Control

ROSS OPERATING VALVE COMPANY

120 E. GOLDEN GATE AVE., DETROIT 3, MICHIGAN

PRECISION-MADE... PERFORMANCE-ENGINEERED ...SERVICE-PROVED

MIDVALE FORGED STEEL SHAFTS SERVE INDUSTRY ACROSS THE NATION

Whether it is mammoth shafts for turbines or generators, or extra heavy shafts of any description, Midvale craftsmanship means top performance. Industry after industry, from coast to coast, has learned to rely on Midvale when specifications are exacting and the job is big.

Whatever your needs for heavy custom-built equipment—whether shafts, rolls, pressure vessels, or any other type of forging—Midvale is your guarantee of precision and performance. For at Midvale, modern equipment and quality control are combined with years of skill and experience to produce the finest, most dependable heavy steel forgings industry can produce.

When heavy forgings must meet rigid specification, rely on Midvale precision craftsmanship.

THE MIDVALE COMPANY

NICETOWN • PHILADELPHIA 40, PENNA.

Offices: New York, Chicago, Pittsburgh, Washington
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MIDVALE

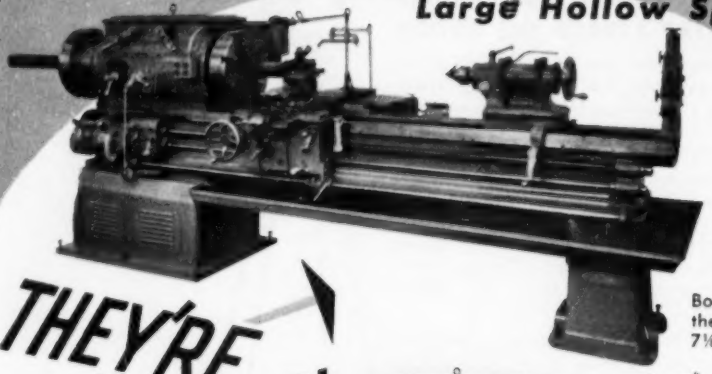
Custom Steel Makers to Industry

PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

FOR FASTER PRODUCTION, BETTER WORK, LOWER COSTS—

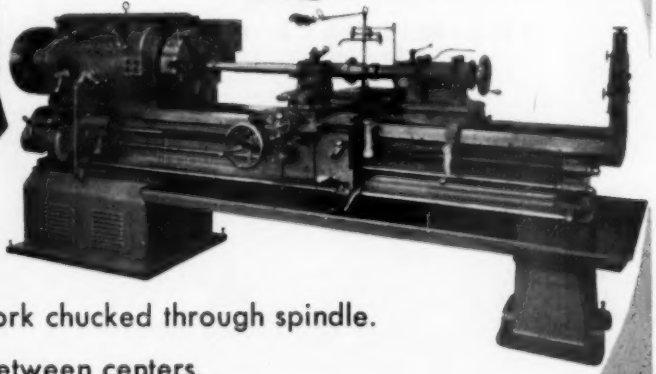
HYDRATROL LATHES

Large Hollow Spindle Type



Both Illustrations Show the 18" Hollow Spindle 7⅛" Hole

THEY'RE VERSATILE!



- Machine long work chucked through spindle.
- Machine work between centers.
- Also built with beds and carriages on each end of headstock for machining both ends of a shaft at one time.

SIZES 18" TO 36"

Small – 18" & 20" up to 7⅛" Hole
Medium – 25" up to 12" Hole
Large – 32" & 36" up to 16⅛" Hole
(Standard Type Lathes 16"-36")

IMPORTANT FEATURES

Timken Bearing Spindles.

Hydraulic clutches for forward and reverse, controlled from apron or headstock.

Hydraulic brake for close position control.

Hydraulic clutches self-compensating. No adjustment and full power capacity at all times.

LEHMANN MACHINE COMPANY

CHOUTEAU AT GRAND • SAINT LOUIS 3, MISSOURI

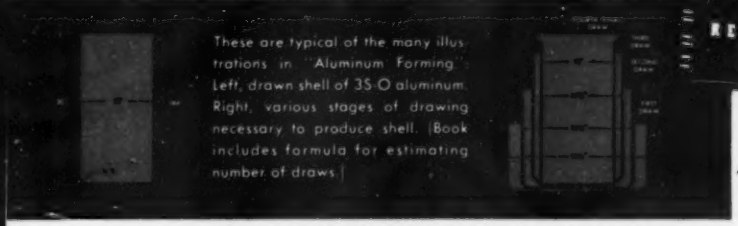
Now Available

"ALUMINUM FORMING"

New Handbook

Write Today! Free when requested on business letterhead.

Everyone who works with aluminum should have this new 148 page handbook, the latest addition to the Reynolds Technical Library. "Aluminum Forming" was published so that design engineers and plant supervisors could have, in a single volume, complete information on the proper techniques for working aluminum. Design and fabricating practices with aluminum are not always like those for other metals. So, in some cases modifications or even special procedures may be required. This handbook fully explains all these procedures and includes more than two hundred and thirty drawings and photographs, twenty-two tables and thirty-two formulas.



These are typical of the many illustrations in "Aluminum Forming." Left, drawn shell of 3S-O aluminum. Right, various stages of drawing necessary to produce shell. (Book includes formula for estimating number of draws.)

Be sure to see "Doc Corkle" with Eddie Mayehoff every Sunday night, 7:30 EST & PCT, NBC-TV; hear "Fibber McGee and Molly" every Tuesday night, 9:30 EST, NBC radio.

For your free copy of the valuable Forming handbook plus a complete index of Reynolds technical literature, write on business letterhead (otherwise price of book is $1.00). Reynolds Metals Company, 2509 South Third Street, Louisville 1, Kentucky.

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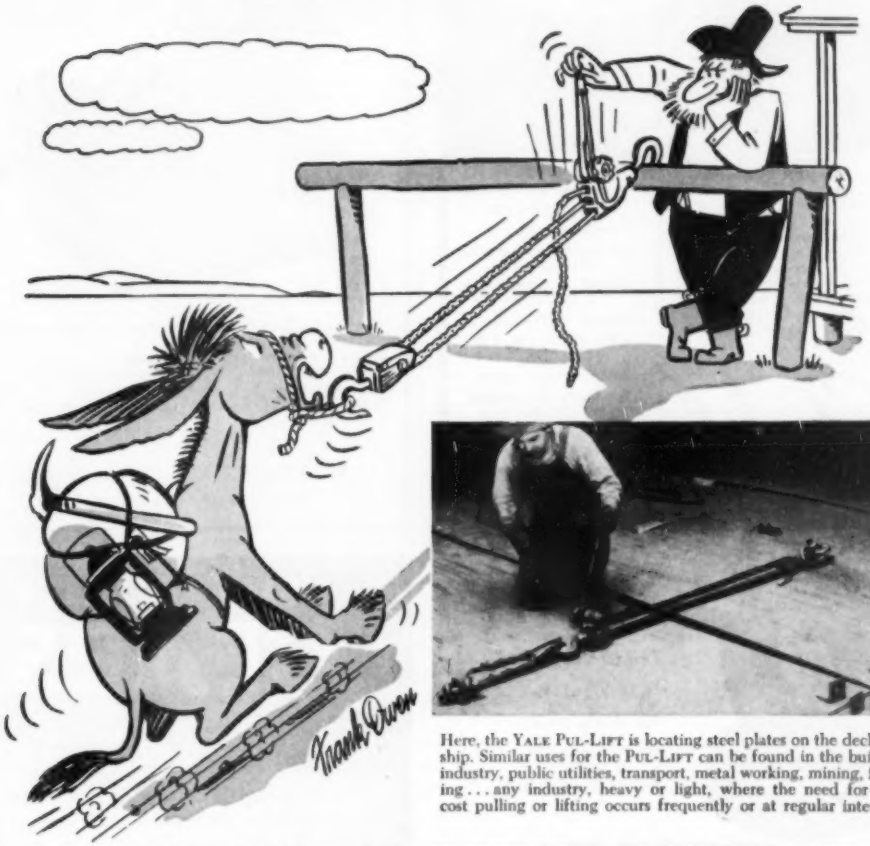

Here, the YALE PUL-LIFT is locating steel plates on the deck of a ship. Similar uses for the PUL-LIFT can be found in the building industry, public utilities, transport, metal working, mining, farming . . . any industry, heavy or light, where the need for low-cost pulling or lifting occurs frequently or at regular intervals.

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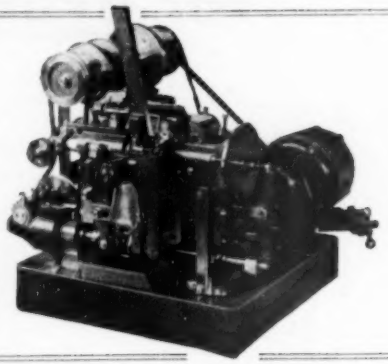

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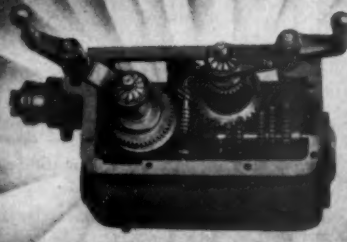

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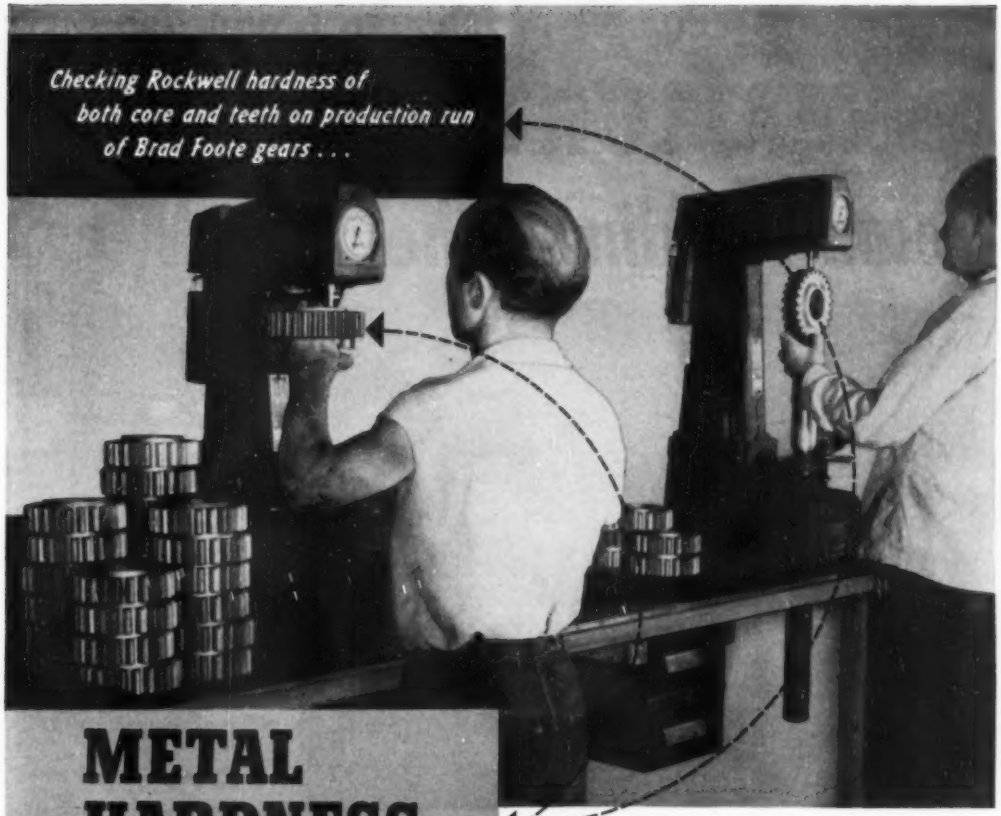

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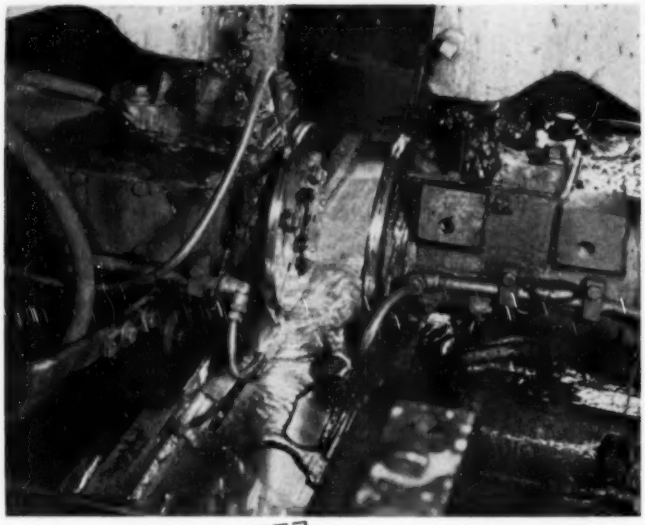
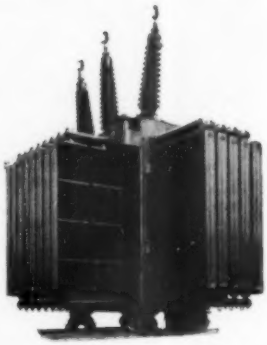
Look at this example of lowered production costs with MALLORY 22 *Seam Welding Wheels*





Typical Westinghouse power transformer showing Mallory 22 seam welded radiators in place.

To fabricate steel radiators like those shown at right above, Westinghouse uses Mallory 22 seam welding wheels on this continuous resistance welding machine which welds two, mated, flat steel sheets.

LOOK TO MALLORY FOR ALL YOUR RESISTANCE WELDING NEEDS

For 25 years Mallory has pioneered a wide range of developments in the resistance welding field—including many widely used alloys and a wide range of electrodes and holders. They offer top performance at low cost. Call on Mallory whenever you need copper base electrodes, holders, dies, castings, forgings, rods and bars for resistance welding applications.

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Production costs dropped for Westinghouse when Mallory 22 seam welding wheels were put to work welding radiators for power transformers. Westinghouse finds Mallory 22 wheels last longer... require fewer dressings . . . cut set-up time . . . thus help speed production and lower costs.

Mallory 22 metal, a copper base alloy containing cadmium and zirconium, offers high strength, high conductivity, and high ductility at elevated temperatures. These characteristics give it great resistance to mushrooming and cracking—thus making it the ideal wheel material for mash seam welding or similar applications where the welding heat is high and where cooling of the wheel may be necessarily inefficient.

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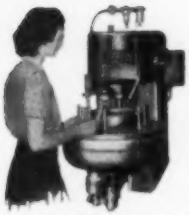
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio.



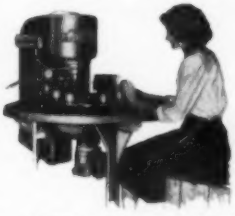
Assembly speed is doubled using Multipress to crimp a small brass contact to pen-type flashlight cases

20,000 mop clamps a day is cost-cutting speed of 35-ton Multipress using roll-feed and 4-stage dies

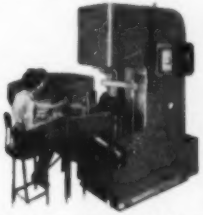
Dies stay sharp twice as long when Multipress is used in trimming flash and gate from die castings

Scrap losses drop sharply as Multipress doubles staking speed on high precision voting-machine counter wheel

Six hours saved on every 100 finished units as famous electric cleaner plant adopts Multipress to clean cast housings



Output is boosted by 100% by famous toy train maker, staking 6-part assembly together with Multipress

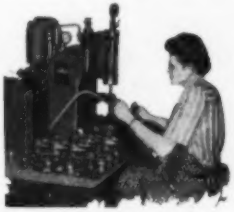


At twice the speed of previous method, Multipress assembles bolts on electrical insulator holders

1600-per-hour rate slashes production costs when 4-ton Multipress is used to broach serrations on small cams

No down-time for repairs in 7 years for Multipress used to bend tabs and arch locks on steel clamps at high speed

Speed doubled on delicate job of drawing thin phosphor-bronze tubes used in forming sensitive thermostat bellows



Less operator fatigue noted as Multipress Midget assembles two check valves to main valves at 450 per-hour

In only four stages, Multipress deep-draws a precision ordnance part formerly requiring 8 draws

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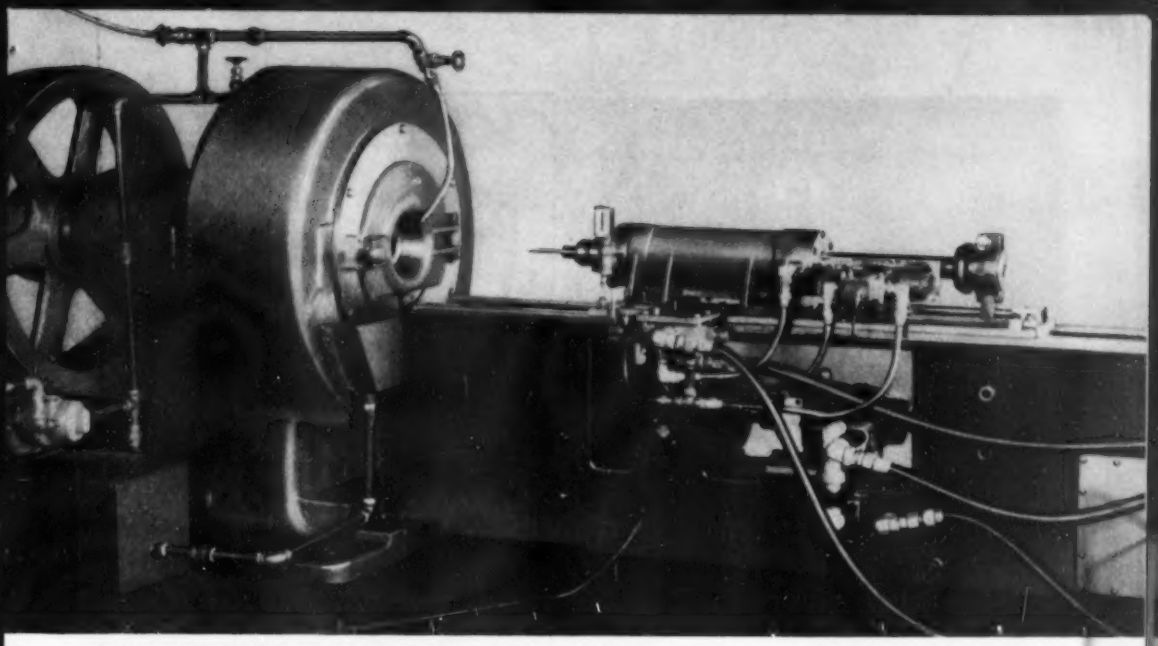

FENN SWAGING MACHINE, featuring hydraulic feed, automatic chucking, and oil-cooled dies, is fast replacing lathes and screw machines for shaping a wide range of metal parts because it . . .

MAKES METAL GO TWICE AS FAR

Yes, you can cut your metal requirements in half, in many cases, with this Fenn Swaging Machine. That's because it doubles the length of the blanks it shapes . . . with absolutely no stock removal.

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What's more, this Fenn Swager produces a denser structure in metal parts . . . maintains concentricity . . . gives an improved finish . . . requiring no subsequent grinding . . . calls for less operator skill than any other machine capable of producing equivalent parts.

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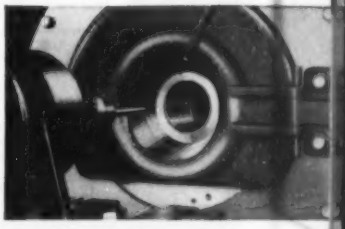
It will pay you to investigate all the cost-cutting, material-saving advantages of the Fenn Swager. Contact the Fenn distributor nearest you for facts and delivery schedules, or write direct to THE FENN MANUFACTURING COMPANY, 1859 Broad St., Hartford 1, Conn.



SIMPLE DIE CHANGES, using blanks in various diameters, make Fenn Swaging Machines quickly and easily adaptable to a wide variety of jobs. You can use them for reducing, pointing, or forming bar stock or tubing. Also for assembling fittings to cables. Fenn Swagers and Hydro-Formers come in sizes and designs for every swaging need.

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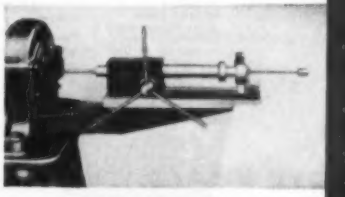

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The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

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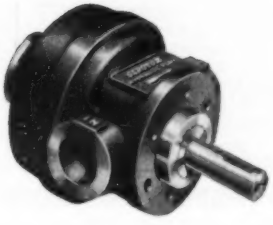
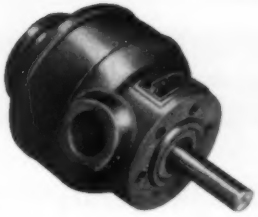


Series "B" Hydraulic Pumps . . . 3 sizes, for continuous pressures up to 1000 p.s.i. Deliveries from .4 to 1.5 g.p.m. at 1800 r.p.m.



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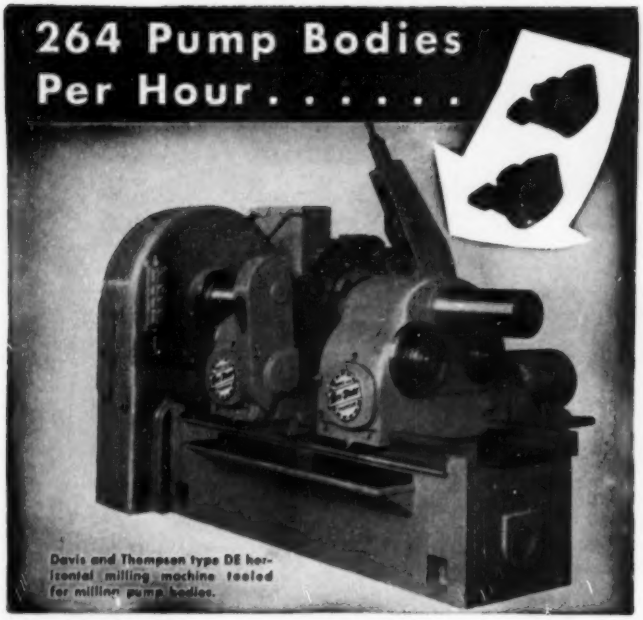
264 Pump Bodies Per Hour . . . . . .



Davis and Thompson type DE horizontal milling machine tooled for milling pump bodies.

1-A Standard Horizontal Milling Machine

Oil pump bodies requiring high degree of finish and high production are rough and finish milled on both sides simultaneously with this Davis and Thompson type DE milling machine. Production is 264 pieces per hour.

Patented Angular Spindle Adjustment Allows "Toe Cutting"—Maintains Fine Finish at High Production

The finishing spindle is provided with an exclusive D&T design which allows angular adjustment. This in turn results in "toe-cutting" and eliminates "drag" of the cutter over the finished surface. Both roughing and finishing spindles have micrometer endwise adjustment.

A Basically Standard Machine Employing Roto-Matic Principle For High Production Special Milling

Like all D&T machines this model DE is designed for long life and trouble-free operation. Each head has independent drive. There is backlash take up to mandrel. Anti-friction bearings throughout. Rapid traverse between cuts can be incorporated.

Free Data will be furnished upon request.

DAVIS and THOMPSON Roto-Matic

Davis & Thompson Company

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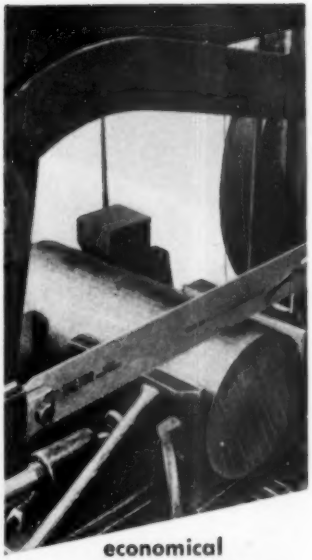

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Whatever your metal cutting problem, VICTOR "Moly"® High Speed Power Blades will cut your initial blade cost 15%, and give you the additional economy of more efficient cutting.

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Makers of Hand and Power Hack Saw Blades, Frames and Metal Cutting Band Saw Blades

From the *American Machinist* Library of *Tips for Top Shop Men*

IF you have worked with your hands, your normal tendency in a crisis will be to work with your hands again. There are times when this will impress the men who work for you, do much to knock down any idea that you're an incompetent stuffed shirt. But never forget that you're paid now for working with your head, and that headwork demands more perspective than handwork is likely to give you. Also remember the thrill you got out of achievement and give the next generation the same chance to grow.

How to Produce and Measure

Precision Flatness and Finish...

On Metals, Ceramics Quartz and Plastics

Many manufacturers are using the Lapmaster in experiments with flatness and finish. In some cases experimental work is carried on in the laboratory and, as a result of the consistency of this machine in producing precision flatness, larger Lapmasters are put into production in the manufacturing line. One such manufacturer of steering gear assemblies saved considerable time over hand lapping of washers and worms. Schools and manufacturers engaged in restricted defense work are finding and utilizing advantages of the old operation of lapping when produced by modern Lapmasters. If you are interested in precision flatness and finish, it will pay you to investigate the Lapmaster. For instance:

Consistent Flatness of 1 Light Band (.0000116") Opens Countless Possibilities For Product Improvement

Manufacturers of pumps, compressors, and equipment containing liquids or air under high pressures have found it possible to eliminate gaskets in mating surfaces because of the extreme accuracy of work produced by the Lapmaster. Quality of surface (RMS) is controlled by Lapmaster compounds. Micro-inch finishes of 2 to 3 RMS are common. Surface flatness can also be held to less than one light band or .0000116". (11.6 millionths of an inch.)

LAPMASTER'S New Principal in Machine Design Offers Cost Reduction *Plus* Consistent Accuracy

Lapmasters are extremely versatile lapping machines. Precision flatness and super finish can be generated in both small and large production quantities. In one cycle, Lapmasters can precision-lap either identical parts or parts of dissimilar shapes and materials.

LAPMASTER Monochromatic Lights and Optical Flats

Here's the equipment you'll need for checking accurate lapping.

The Monochromatic Light is a sturdy, completely self-contained and portable precision instrument that can handle any size part. Reversible light head permits checking normal size pieces on the stage, larger parts on a table. Light is of high power to show visible bands on relatively long polished surfaces and materials difficult to check. Power supply is a 5000 volt transformer operating on 110-120 V., 60 cycle current.

Lapmaster Optical Flats offer the most accurate standard of measurement available. They are made of highly transparent quartz which holds its shape indefinitely, is abrasion resistant and resists thermal shock. Flats are available to a standard of either 1/10 or 1/5 of a light band across their diameter.

Additional Data

on this outstanding machine is available on request. Write today for Bulletin AM-10.

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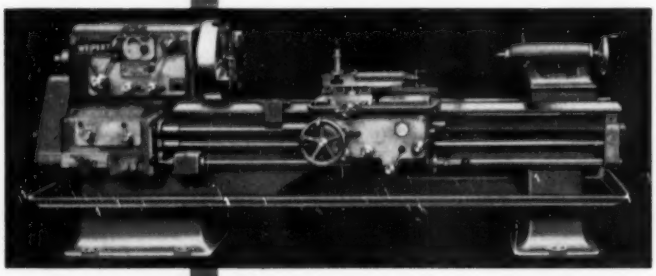
precision built, custom finished—immediate delivery!

U. S.-made Timken bearings
American Standard taper key spindle nose
Swings over ways—20″
Center Distances—60″, 78″, 96″
18 speeds, 12 to 600 rpm.
44 feeds, .005 to .780 inch per rev.
Leads to 4″—English, module and metric threads
Motor recommended—7½ hp.



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From the *American Machinist* Library of Tips for Top Shop Men

SABOTAGE is a greater potential danger for most plants than bombing. Have you taken any precautions to guard against it?

MORALE isn't built in a crisis; it's built beforehand. The crisis only tests it.

THERE'S an old saying that "If you want to be big, you've got to look big." Nobody likes a fourflusher or a fop, but everybody has been trained from childhood to expect a leader to look like one. Company policy can't earn respect on the major things either, if it is small on the minor things. Don't make your company look small.

Microstructure determines tool life . . .

U. S. AIR FORCE MACHINABILITY REPORT 1951

This *American Machinist* Special Report summarizes recently released data from the $100,000 machinability-research project conducted by Curtiss-Wright and other companies for the United States Air Force.

You will find particularly valuable, as a key to estimating the tool life cutting speed of any steel, this report's comprehensive chart of 12 steel structures under four metallurgical conditions.

Copies of this 8-page Special Report, which includes information on machinability as influenced by heat-treating and alloying, are available at 15 cents each.

Write for an editorial reprint order form listing titles and costs of other informative Special Reports.

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After 3 months of trial Iron Fireman chose ADAMAS CARBIDE to lick this job!

ADAMAS Grade D proved most successful in trepanning Air Force Fitting

PROBLEM: Trepanning a groove 7/16" wide x 2-3/16" deep in a 5" diameter fitting for the U. S. Air Force maintaining 125 micro-inch finish in a semi-finishing operation holding a .005 tolerance on a Warner-Swasey #5 Turret Lathe.

MATERIAL: WD 4140 steel forging heat treated to Rockwell 35-40 C, PSI 140-190,000.

SOLUTION: After an extended analysis it was found that ADAMAS Grade D gave excellent performance and long tool life.

With the aid of Adamas Carbide, the Iron Fireman Manufacturing Co. of Cleveland, Ohio was able to complete this job on schedule with maximum efficiency. This is another working application of Adamas job-engineered grades.

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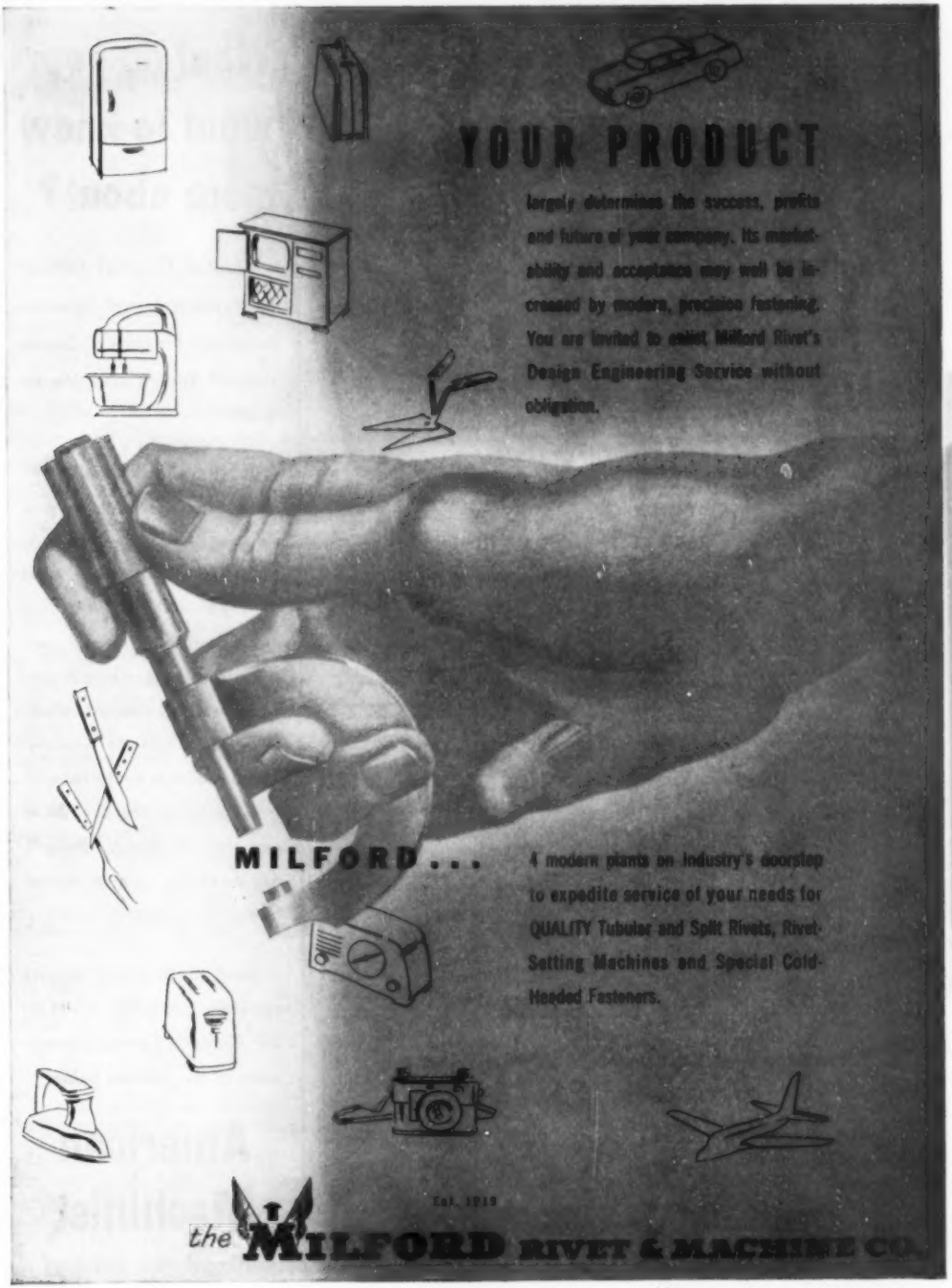
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The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed" tap shanks. Holds tap true.

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From the *American Machinist* Library of *Tips for Top Shop Men*

ONLY two of your possessions increase in value proportionally with price inflation. One is time, the other knowledge. You can employ both productively to build security, or squander them.

MICROSTRUCTURE, rather than composition, may frequently be the key to successful machining of a part. Two pieces that look alike and were made alike may be entirely different in their reaction to a tool.

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Rigid Construction • Easy Operation

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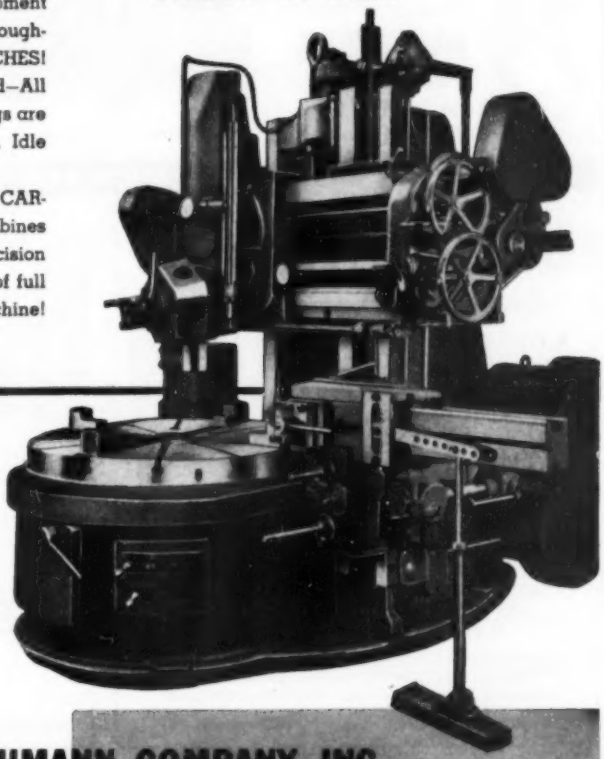
Precision made in Germany, this fine vertical turret lathe is equipped with American built motors, American built electrical equipment and conforms to American standards throughout. ALL GRADUATIONS ARE IN INCHES!

Speeds and feeds are easily controlled—All levers, manual and rapid traverse settings are controlled from the operator's position. Idle time is reduced to a minimum!

Designed for turning with TUNGSTEN CARBIDE TOOLS, the Deutsche Niles combines extremely rigid construction with precision workmanship to make possible the use of full power input without overloading the machine!



Partial Specifications

	41"	55"
Swing with side head in position	41"	57"
Swing with side head below table	51"	57"
Vertical travel of ram	31"	23½"
Horizontal travel, side head	19½"	27½"
Speeds (12)	11.8 to 150 RPM	5.1 to 80 RPM
Motor Drive	25 HP	30 HP

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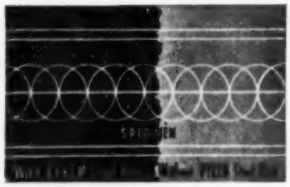

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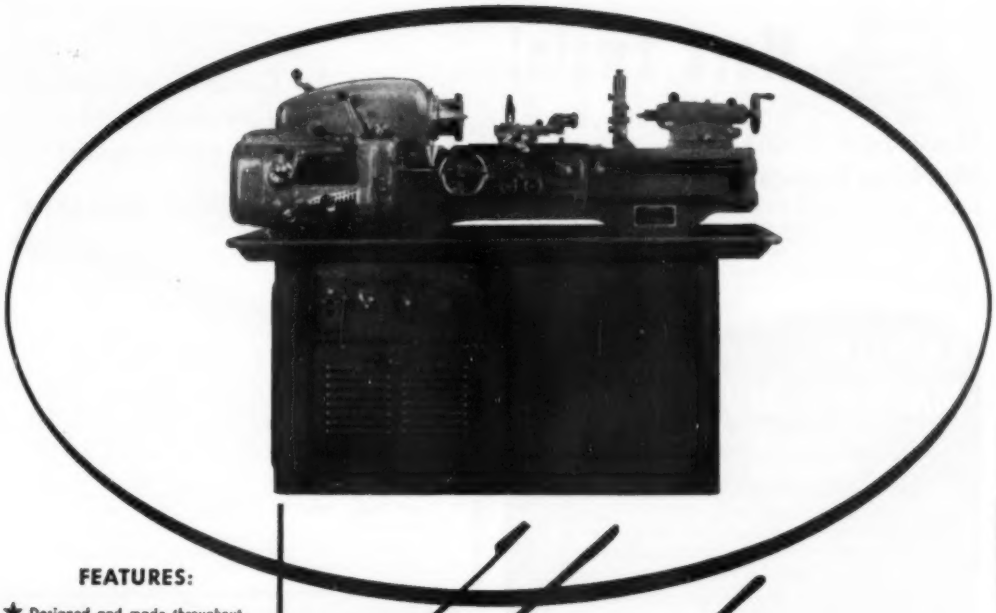

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9" x 24" TOOL AND GAGE-MAKERS' LATHE

FEATURES:

- ★ Designed and made *throughout* for PRECISION.
- ★ Hardened and precision ground bed ways.
- ★ Sixty-six thread cutting and feed changes *without* gear change.
- ★ ALL spindle speeds are stepless, 25 to 2000 RPM, forward and reverse.
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- ★ Spindle runs in preloaded, super-precision, anti-friction bearings, both ends.
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- ★ Special clamping device for tailstock.

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The Hendey 9" x 24" Tool and Gage-Makers' Lathe is a high-speed precision lathe — designed to satisfy the universal demand of expert tool and gage makers for a precision lathe of heavier design and greater adaptability. It has a swing over the ways of 10¼" and over the cross slide of 5⅛". Maximum capacity of spring collets is 1⅛". A choice of the M. G. Variable Speed Drive or the new Hendey Electronic Drive is available. This tool and gage-makers' lathe will perform all operations within its scope most accurately and efficiently — it will save time and money, and eliminate spoilage of work chargeable to inaccuracy, insensitivity or incapacity of lathe equipment.

Hendey is especially qualified to manufacture such a lathe, because, for more than 70 years it has made lathes which have proved its claim of "Prestige with Production."

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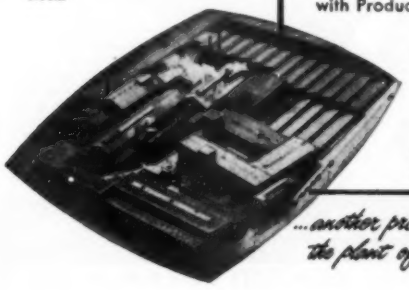

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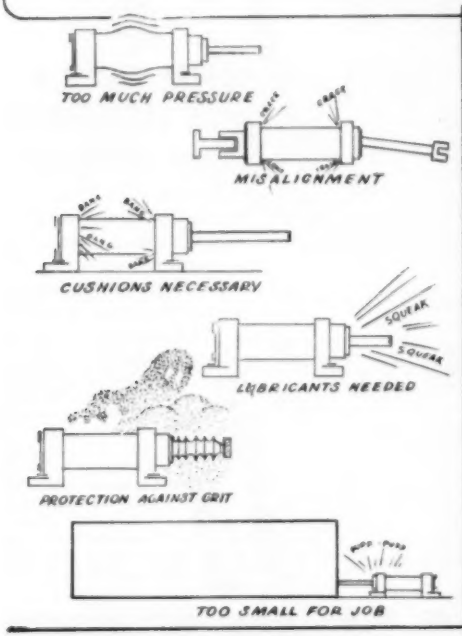
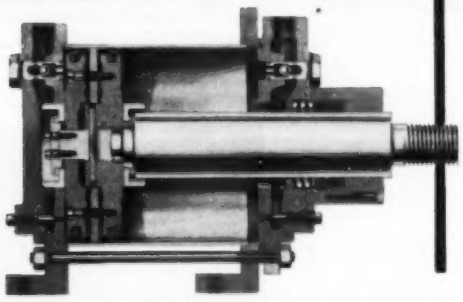




WHEN YOU INSTALL an air cylinder you want to insure the long life and trouble-free performance for which the cylinder was designed. Cylinders of ample capacity for the job should be used . . . Operating pressure should not exceed maximum cylinder rating. Trouble is often caused by use of the improper cylinder mounting style and by the piston rod being incorrectly aligned with the load to be pushed or pulled. Where the atmosphere contains moisture or abrasive dust, piston rod protective boots are desirable. Speed control valves in the air line may be necessary, particularly in moving high inertia anti-friction loads horizontally. Standard cushions, or even "super" cushions may be needed. Filters and lubricators are desirable.

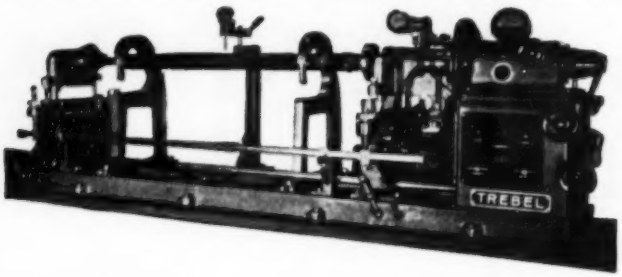
WHEN YOU INSTALL a HANNA® Air Cylinder you have the *best* assurance of long cylinder life . . . you have consistently efficient performance . . . you have minimum maintenance. Hanna Cylinders combine such important features as removable bronze check valves, piston-packing expander rings, floating bronze cushion sleeves, self-adjusting, spring-backed rod packings and two-piece threaded flange and head construction.

YOUR BEST GUARANTEE of carefree cylinder operation is your specification of Hanna Cylinders followed by correct installation. The Hanna Cylinder and Valve Line has sufficient breadth to best meet your particular power needs. Send for the new Hanna Low Pressure Catalog No. 236 to get full information on the complete line.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1740 Elston Avenue, Chicago 22, Illinois



Balancing this 60" propeller shaft is no trouble with a TREBEL

THE propeller shaft is first dynamically balanced by spot welding two compensating weights onto the shaft ends near the universal joints. The exact size and location of these weights is indicated by the machine. Shaft is then accelerated to its critical speed and amount of deflection *read off a dial*. A third weight is welded on in the middle of the shaft opposite the point of maximum deflection to insure a smooth running condition at all speeds.

A variable high speed control, free wheeling, safety latches and tachometer are provided for the spin test.

Shafts up to 96" long, weighing from 20-130 pounds are accurately and quickly balanced in the TREBEL DEK 60e DYNAMIC balancing machine —also crankshafts, flywheels, electric armatures, etc. with a range of 20-260 pounds. Guaranteed accuracy is .1 ounce-inches or .00002 inches displacement of center of gravity.

Unique Balancing Principle using a counter force to compensate for unbalance eliminates complicated setups and makes possible the indication in simple, easy-to-read units such as length of wedges in inches, or depth of a standard diameter hole, etc. Delivery is prompt. May we send you full details?

See the TREBEL in operation in New York, Detroit or our Cleveland Service Center.

KO **KURT ORBAN** COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit 35

Canadian sales by European Machinery Ltd., 11 King St. West, Toronto, Canada

END MILLS and HOLDERS — by Reltool

Precision processed of finest high speed tool steel, and scientifically heat treated for long cutting life . . . *Reltool End Mills are famous for long cutting life. Available* in single- and double-end types, in small and large diameters, with 2, 3, and 4 flutes, with straight or ball ends, in over 1000 stock sizes.

• RELTOOL END MILL HOLDERS are made in both Tang and Draw Bar Style, and with Morse or Brown & Sharpe Taper. Sizes over ¾" have Dual Set Screw. For complete list of sizes and prices see Reltool Catalog No. 50 and latest Discount Sheet.

Reltool CORPORATION
RELIABLE METAL CUTTING TOOLS
4540 W. BURNHAM ST. • MILWAUKEE 46, WIS.

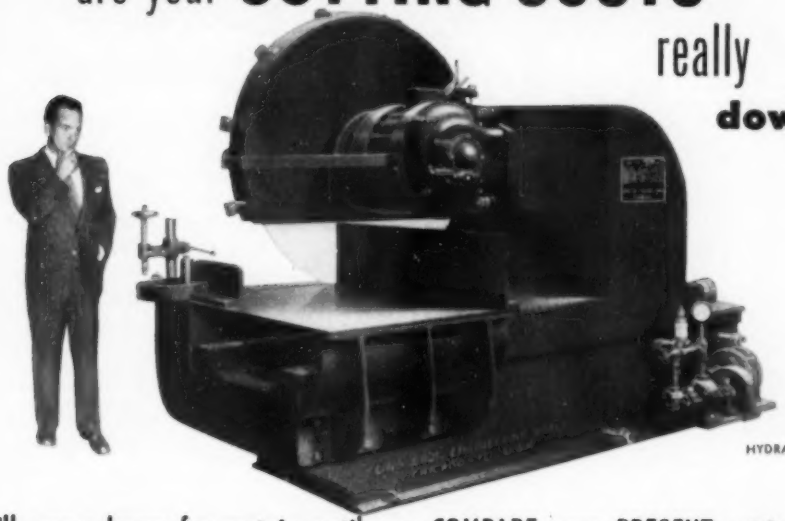
A 5968-½

From the *American Machinist* Library of *Tips for Top Shop Men*

TAKE a man's pride in his job away, and there isn't much left; he becomes another automaton. Even a trained seal enjoys the applause as much as he does the fish.

WHEN you walk the tight-rope between close tolerances, or between good and bad finish, balance is vital. Be sure you have it, in machine-tool spindle or shaft, in tooling, in fixture. It will pay out in longer tool life and reduced scrap.

are your CUTTING COSTS really down far enough ?



HYDRAULIC FEED

you'll never know for certain until you COMPARE your PRESENT cutting speed with

the faster Kling *HIGH SPEED* FRICTION SAW!

What is friction sawing?

It's a proven method of cutting metal by generating heat through friction on the part to be cut at a rate faster than that part can absorb heat. This temperature increase reduces the tensile strength of the piece to the point that the weakened surface can no longer resist the action of the colder blade. The metal is thus easily removed with no apparent wear on the blade surface.

Fastest, all-around cut-off machine in the shop!

Cuts all types of steel, hard or soft, big or small, in any shape, without distortion. For day-in, day-out production, one Kling Friction Saw will do the voldme of work that would ordinarily require several separate shears or slow speed saws. One of the big time-saving reasons is the ability of the Kling Friction Saw to cut any structural shape, without change of blade or setup. Because the average Friction Saw blade will give a good full day's production before requiring redressing, you eliminate costly downtime and also save on tool costs.

FREE complete, friction sawing information!

Learn how you can profitably apply Kling Friction Sawing in your plant. The information contained in this 12-page bulletin will give you the complete story on Friction Sawing . . . including the principles of the process and some of its applications. Write today for your FREE copy.

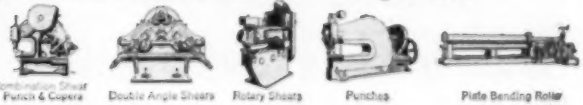
KLING BROS. ENGINEERING WORKS
1318 N. Kostner Ave. • Chicago 51, Illinois

How long would it take you to cut these pieces?		With a Kling friction saw you could do it in approximately . . .
24" 100 lb. I Beam	⊢⊣	28 seconds
15" 55 lb. Channel	⊏	15 seconds
8"x8"x34.3 lb. H Beam	H	10 seconds
100 lb. A.R.A. Rail	I	9 seconds
6-1/2"x6-1/2"x19.8 lb. Tee	T	5 seconds
8"x8"x3/4" Angle	∧	11 seconds
3" Square	■	10 seconds
4" Round	●	15 seconds
6" O.D. Tube, 1/2" Wall	○	11 seconds

*What's your requirement? There's a size to fit your specific needs—large or small

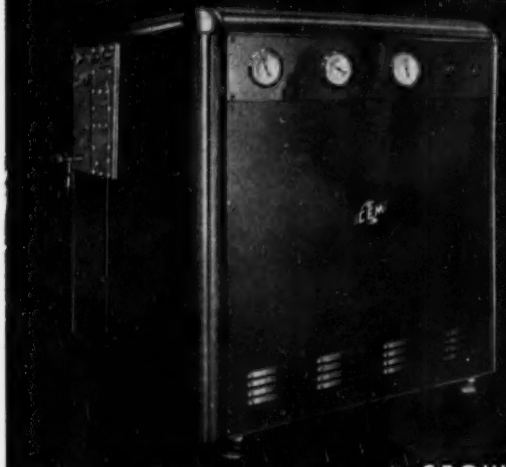
in our 60th Year

Kling ...an investment in speed!



Combination Sheet Punch & Copers | Double Angle Shears | Rotary Shears | Punches | Plate Bending Roller

The CEM OIL COOLER — *can save you money!*



Cooling the liquids used in many industrial operations cuts costs . . . increases production . . . improves product quality and gives longer tool life. The Cem Oil Cooler will control the temperature of industrial liquids of all types—cutting oils or fluids, quenching liquids, hydraulic oils, etc.

DOUBLE-DUTY
Because it has two separate cooling lines, this unit can be used on two operations at the same time, even though two different liquids are being used.

CAPACITY RATING
Cools cutting oil at the rate of 200 gallons per hour for two drilling operations at the same time. Capacity on other operations in proportion, depending on working conditions.

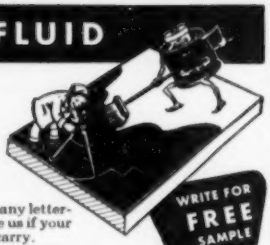
PROVED PERFORMANCE
In use for more than two years on a variety of industrial operations. Also in our own machine plant under the critical observation of our own engineers.

NON-CORROSIVE
Cooling lines made entirely of stainless steel tubing. There is no danger of contaminating the liquid.

Write for detailed information today!

CROWN CORK & SEAL COMPANY
Machine Sales Division · Baltimore 3, Md.

LAYOUT FLUID
FOR ANY METAL



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Ever have a tap or drill break in an expensive part? . . . so that even careful drilling couldn't save it? Today, parts costing as little as 50c can be economically salvaged by an Elox Electron Drill.* They're real money savers! No plant can afford to be without one. Write for particulars.

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choose **FERRACUTE INCLINABLES**
Fast . . . economical . . . dependable
Complete line of mechanical presses. Since 1863
FERRACUTE MACHINE CO., Bridgeton, N. J.

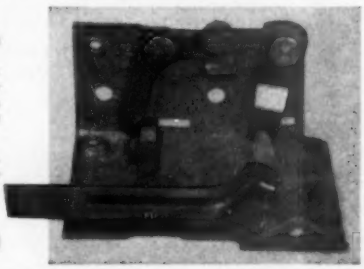
DIES *for making auto door lock parts on a production basis — designed and made by* SCHNELL

● The four parts shown in relief on this door lock were produced with progressive dies designed for customers' presses by Schnell.

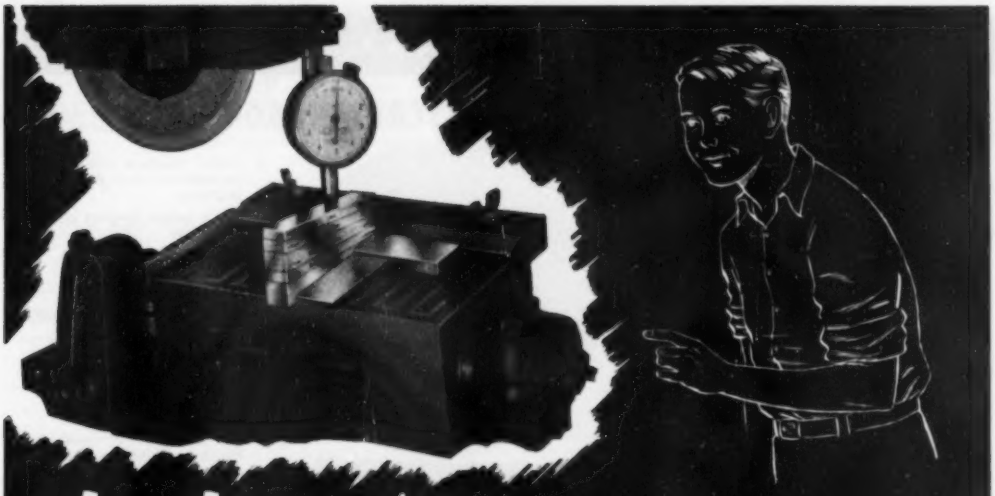
These are high production jobs with dies designed for adjustment and sharpening without replacing sections. They also feature a safety device whereby a pilot hits and operates a micro switch which stops machine instantly in case of a mis-hit. A production rate of 70 pieces per minute was achieved on this job for each piece.

This is a typical example of the ability of the Schnell organization to carefully analyze your problems and come up with dies that will enable you to maintain high production, with safety and at minimum cost.

Consult Schnell on your die and tool requirements, also on the production of complete units. They have the engineering organization, plant facilities and equipment to help you.



SCHNELL TOOL & DIE CORP., SALEM, OHIO



Any Apprentice

can inspect this angle in a few minutes . . .

Degrees, minutes and seconds in any combination are at your finger tips with a positiveness and speed that has never before been equalled — Webber Angle Blocks are the world's standard of angle measurement

No complicated setups, no sine bar, no sine table or variables in method. An apprentice can set up and inspect an angle with complete reliability. It takes just a few seconds to add up the figures on the blocks that check his work.

Webber Angle Blocks are now the standard of angle inspection in hundreds of metal working, optical and scientific instrument industries.

One set of blocks can save controversy, time and expense. The saving on a single inaccurately ground workpiece often pays for the set. Write for complete information showing how blocks can be used to simplify procedure.

Webber GAGE BLOCKS

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STANDARD STEEL

ANGLE BLOCKS

HEAVY-DUTY BLOCKS

LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

Designed to take full advantage of modern high speed cutting tools!

BMW **Single Spindle AUTOMATIC SCREW MACHINE**

Model RA 13

IMMEDIATE DELIVERY . . .
NO PRIORITIES REQUIRED

- Clean, compact appearance embodying latest design features.
- Rigid design assures minimum vibration.
- Speeds up to 5800 RPM.
- Easy toolsetting and maintenance.
- Short and rigid work spindle mounted in precision roller bearings.
- Operating cams easily changeable and completely protected by detachable guards.
- The 6 hole turret head and the 3 tool slides are of extremely rigid design, with protected slideways and micrometer adjustment.

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Sphero-Conical
DIAMOND **BRALE**® PENETRATOR
for Hardened Steel

HOW IT WORKS

A. Minor Load Penetration
B. Major Load Penetration
C. Linear measurement of penetration increase which "ROCKWELL" converts to hardness reading

***BRALE* Penetrator Accuracy Is Proved in Wilson's Standardizing Laboratory**

One point of hardness on the Rockwell C scale equals .00008", so penetrator accuracy must be constant. That's why Wilson maintains its Standardizing Laboratory for testing and approving every BRALE penetrator.

Each BRALE is precision ground to shape under high magnification to research laboratory accuracy. Wilson's BRALE Penetrator gives true readings at all dial points. For accuracy use a diamond BRALE penetrator on your hardness tester. Write for literature.

ACCO *"Trade Mark Registered*
WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE
230-B Park Avenue, New York 17, N. Y.

WILSON "ROCKWELL" and TUKON Hardness Testers

Precision power presses and feeds in a wide range of types and sizes to meet every requirement.

See Pages 22, 23
September 29th, American Machinist

THE V & O PRESS CO. *Division of Emhart Mfg. Co.* HUDSON N. Y.

***Severance* CARBIDE MIDGET MILLS**

Operate at grinding-wheel speeds
Outlast scores of mounted points
Cut 50 times faster
MANY SHAPES and SIZES
Cut hard materials - Rockwell 65-C
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May be REGROUND time-after-time by Severance—savings are thus multiplied

In Canada: 60 Front St. West, Toronto
Severance Tool Industries Inc., 726 Iowa Ave., Saginaw, Mich.

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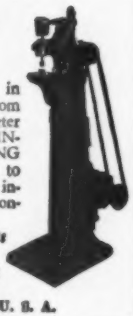


RIVETERS — PIONEERS in their line—head rivets from smallest to 3/4" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

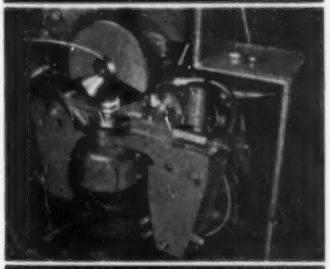
THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

PRODUCTION Short-Cuts with PINES Hydraulic BENDING EQUIPMENT

Tooling Set-Ups Engineered To Meet Your Needs

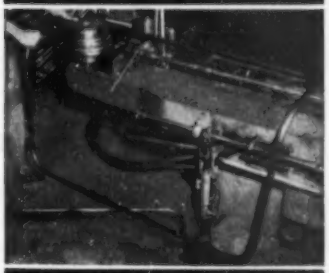
Here are five examples of bending applications illustrating how Pines machines are successfully employed to save time and cut costs on a wide range of bending work. As shown, different tooling setups are engineered and easily applied to handle a variety of production requirements. Hydraulic power, which is used on all Pines Benders, assures accurate, uniform production results and safe, dependable performance. Push-button controls and automatic operation assure high efficiency and production economy. There's a complete range of Pines Benders designed to handle light or extra heavy work, small lot, or high production runs. Call on Pines engineers when you need help with a bending problem. There is no obligation. Phone Aurora 2-7608.

1. MULTIPLE GROOVE DIE — on Pines Size 3 Automatic Bending Machine forms ten 7/16" x 67-1/2" steel rods simultaneously to a 22" radius for farm implements.



2. DOUBLE DIE AND CUT-OFF SETUP — on Pines Size 3/4 Automatic Bender. Produces 3/4" copper return bends to 7/8" c/l radii automatically, two pieces at a time.

4. FORMING BLOWER HOUSINGS ON PINES ROTARY BENDER — bends irregular curve (radii of 5-17/32" to 7-3/4") in 5-1/8" width stock at a speed of 89 pieces per hour. Floating bronze pod acts as a wiper shoe, maintains uniform pressure, assures smooth, wrinkle-free results.



3. TRIPLE RADIUS SETUP — on Pines Size 3/4 Automatic Bender handles three different radii and six 90-degree bends in 1-1/8" tubing in fast sequence. Increases truck seat frame output with less handling.

5. PINES SEMI-AUTOMATIC BENDER — tooled for production-line bending of extruded aluminum automotive moldings. Simple setups and easy manual toggle clamping also provides unusual economy for variable short-run and maintenance work not adaptable to fully automatic equipment. Hydraulic power assures uniform results, safe operation.

***Write* TODAY FOR FREE LITERATURE**

Write for free literature describing and illustrating various Pines Benders, attachments, and methods on actual jobs. Find out how Pines Benders are designed to save time and cut costs on a wide range of work.

PINES ENGINEERING CO., INC.

. Specialists in Tube Fabricating Machinery

BENDING · DEBURRING · CHAMFERING · THREADING MACHINERY

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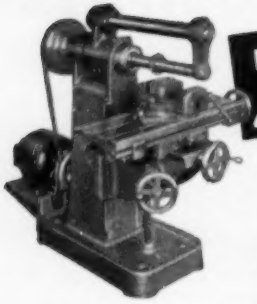

BENCHMASTER pays off 5 ways!

Where else can you find a low cost tool with so many cost-cutting possibilities?

1 FOR HORIZONTAL MILLING quill and overarm slip quickly and snugly in place. Timken Tapered Roller Bearings provide a rigid spindle support at high speeds as well as low. No. 2 Morse Taper. 12½" horizontal table travel with a big 6" x 18" table area.

2 WANT A VERTICAL MILLER?

The same machine is quickly converted by substituting this special head. Again Timken Tapered Roller Bearings give smooth, chatter-free performance over a wide speed range. Accessories available: Full line of Benchmaster collets and drawbar; swivel-base vise.

3 WHEN IS A MILL NOT A MILL?

Here's a handy kink to obtain extra *lathe* facilities for facing, turning, forming, etc. Benchmaster Accessories required: Tapered Adapter and Tool Block. By lowering knee position and raising tool you can swing up to 23". Exceptional capacity!

4 QUICK CHANGE ARTIST

Here's the Benchmaster converted to a grinder! Free-rolling bearings maintain high spindle speeds without overheating or risking bearing injury. Grinds internally, surfaces, sharpens cutters, etc. None Benchmaster 6" Rotary Table—a fine accessory.

5 AND NOW IT'S A DRILL PRESS

The No. 2 Morse Taper in spindle accepts standard Jacobs Chuck Shank. Raising table feeds work into drill. With this setup, drilling layouts is easy—simply measure off correct hole spacing with the lead screws.

★ For Precision
★ For Quality
★ For Value

You can't beat a BENCHMASTER!

NOTE: BENCHMASTERS are also available with rack and pinion feed. For production work this provides exceptionally fast operation.

BENCHMASTERS are accurately built with all the care and precision of larger, more expensive tools . . . yet may be purchased for a fraction of big machine cost! Get our circulars on all BENCHMASTER EQUIPMENT!

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MANUFACTURING COMPANY

1035 W. ROSECRANS AVENUE,
GARDENA, CALIFORNIA

From the *American Machinist* Library of *Tips for Top Shop Men*

THE common belief that "perishable tools" are written off when they go out to the machine is one of today's most expensive notions. Unless control is exercised *in use* as well as in stocking, the machine, method or man that breaks or ruins an excessive number of tools is never spotted. In one test, ratio of tool use on two machines of the same type on the same job was 1 to 7.

Over-age Machines Cost You Money!

Over 42 per cent of metalworking production equipment was over 10 years of age in 1949 . . . 19 per cent was bought more than 20 years ago. These machines have had an average of a quarter century of use, including five years of wartime overwork and mistreatment.

How does *your* production machinery and equipment compare with your competitors', and with the Metalworking Industry's in general? The answers will be found in the *American Machinist* Mid-Century Inventory of Metalworking Production Equipment.

Here are all the facts on the age and number of 155 major types of production equipment operating in 15 metalworking divisions and 25 major production areas. Cost is $2.00 per copy.

Write Reader Service Department:

American Machinist
McGraw-Hill Building
New York 36, N. Y.

Save
¼ the investment
and ⅗ the floor
space
Double
all production
estimates

Airfeedrills

IN A MULTIPLE DRILLING FIXTURE

MANUFACTURER: Name on request

PROBLEM: Drill twelve accurate holes in half a million 24ST aluminum parts

CONSIDERATIONS: Large investment uneconomical because of limited demand. Shop floor area at a premium

SOLUTION: A fixture with eight Keller Airfeedrills, four with dual spindles

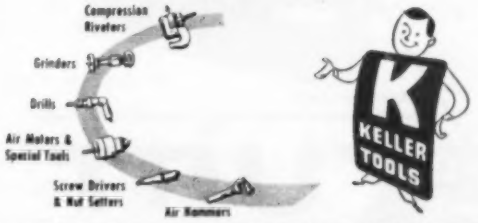
PRODUCTION ESTIMATES: Up to three hundred parts per hour

PERFORMANCE: Sustained production of six hundred or more parts an hour—five thousand per 8-hour day

FEATURES

- Accurate holes without costly fixtures
- Attaches in any position at any angle
- Operates entirely by air
- Used in tight places or close centers
- Wide range of speeds and strokes
- Detachable to shift from job to job

KELLER
Pneumatic Tools

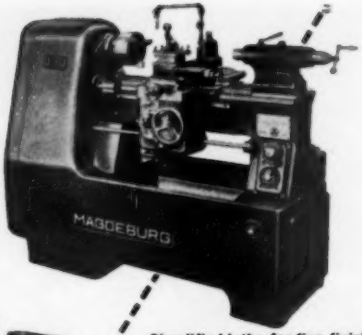


KELLER TOOL COMPANY, GRAND HAVEN, MICH.

AVAILABLE FROM STOCK

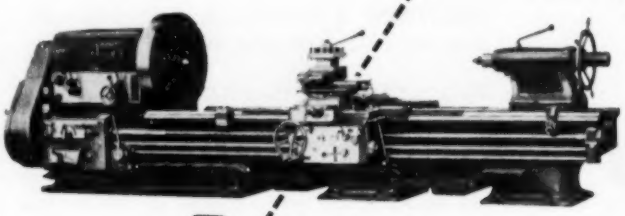
Delivery helped sell these tools... now Industry's sold on their performance

Production-minded plants want more than just delivery on machine tools – foreign or domestic. They want performance and reliable servicing–and they're getting both – reordering these German precision-built tools. Write for complete details.



Simplified lathe for fine finishing and high-production–MAGDEBURG PRECISION LATHE with V-belt drive provides accuracy of precision boring machines... does work of fine finishing lathes in around-the-clock production. Operation is simple: one lever controls forward and reverse rotation, speeds and spindle brake. Steel with tensile strength of 110,000 psi can be cut to a depth of 0.158" with a feed of 0.004". Includes contour attachment.

Quick changeover from job-to-job on short or long run heavy-duty drilling production is assured by easily adjustable head and table on new ALFING DRILL PRESS. Crank *raises* or *lowers* table; headstock moves 6" up or down by hand on scraped ways. Easy-to-reach controls cut handling time, too. 9" spindle stroke, driven by either V-belt or flange-mounted AC motor. Motor speed 900 rpm. Drilling capacity of 1" in steel; 1¼" in cast iron. 8 spindle speeds from 150 to 1640 rpm. Drilling feed by hand or power. Table surface 26" x 28". Distance between spindle and table, 23" max.; spindle and base plate, 25"-40".



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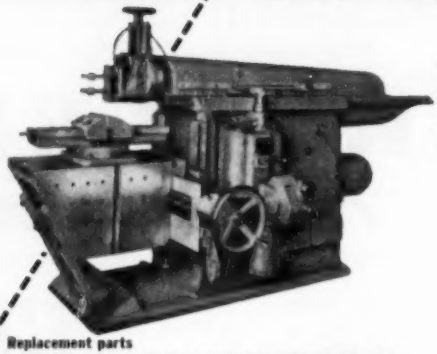

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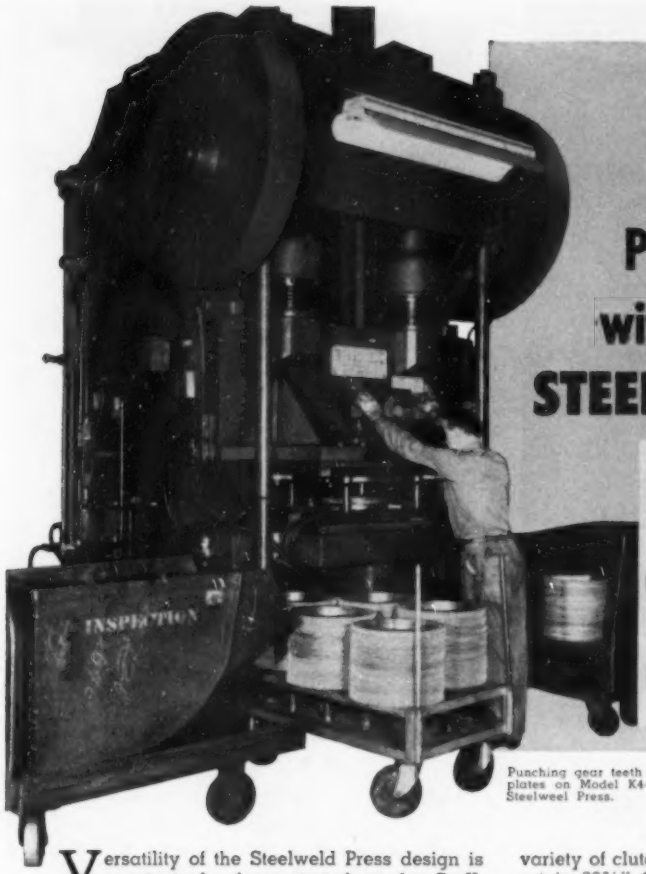
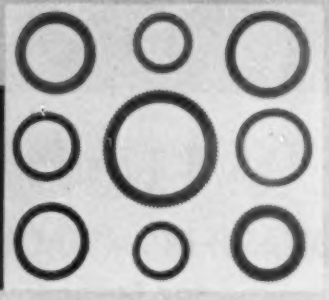


Punching gear teeth in clutch plates on Model K4-4 300-ton Steelweel Press.



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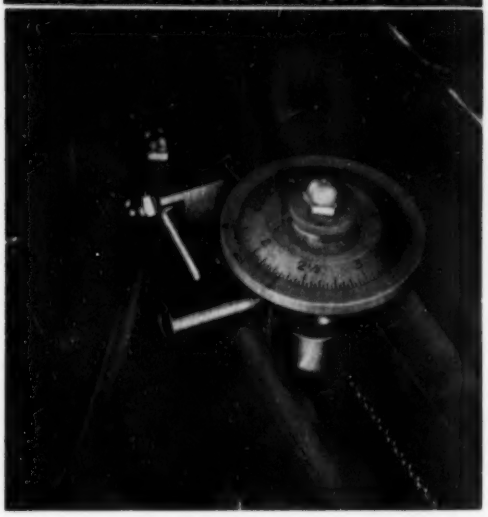

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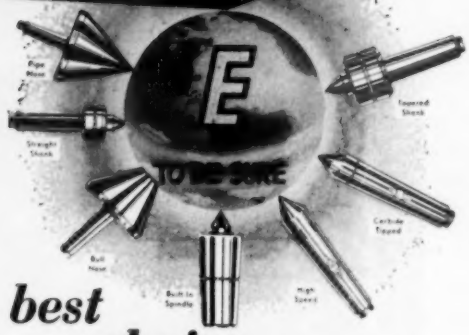

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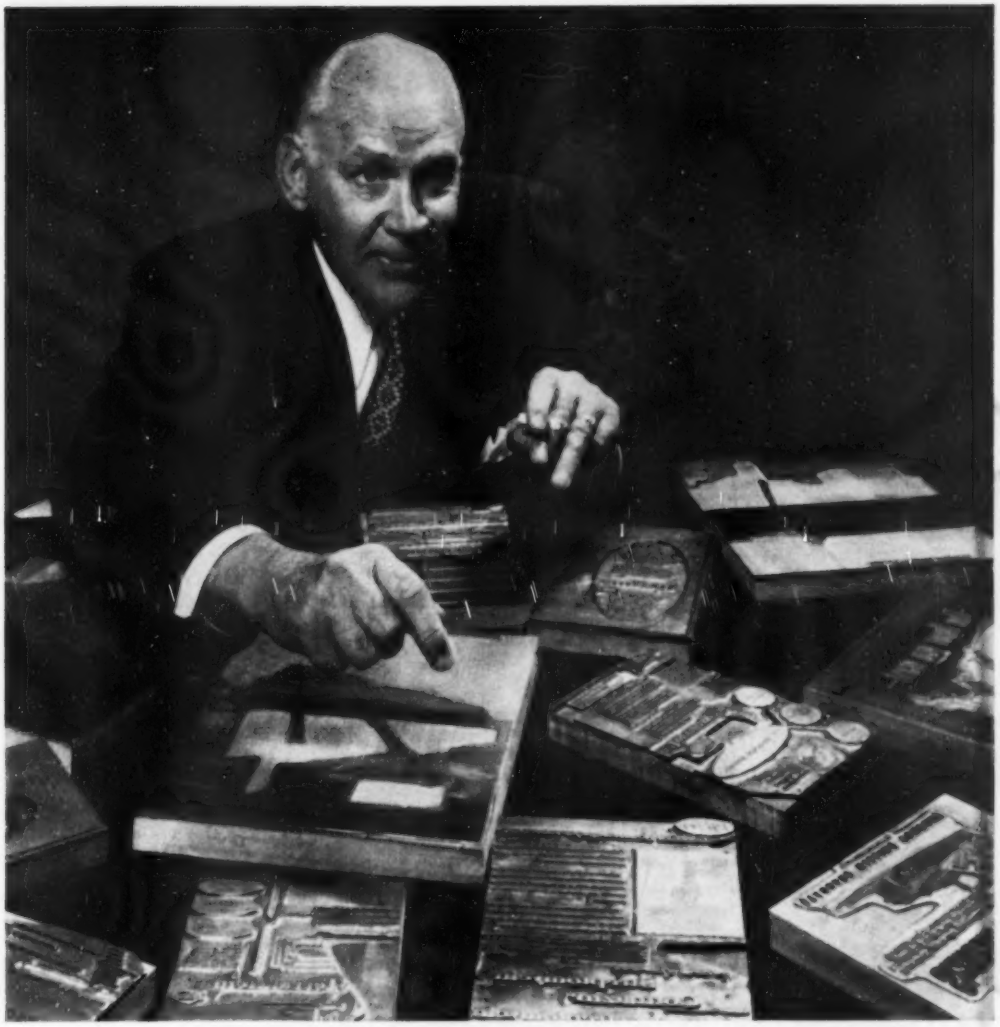

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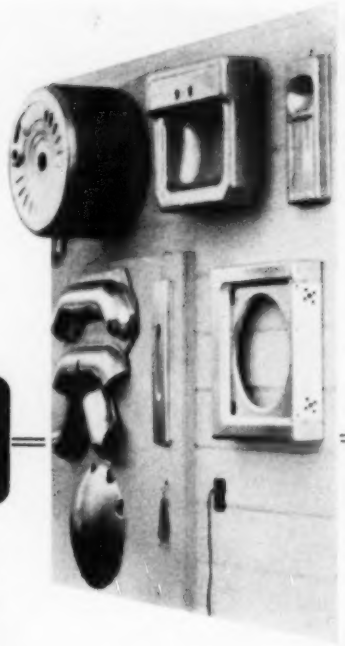

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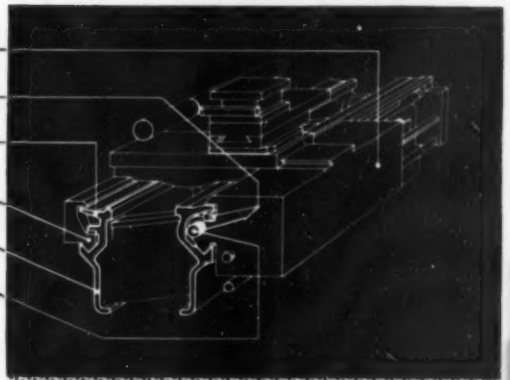

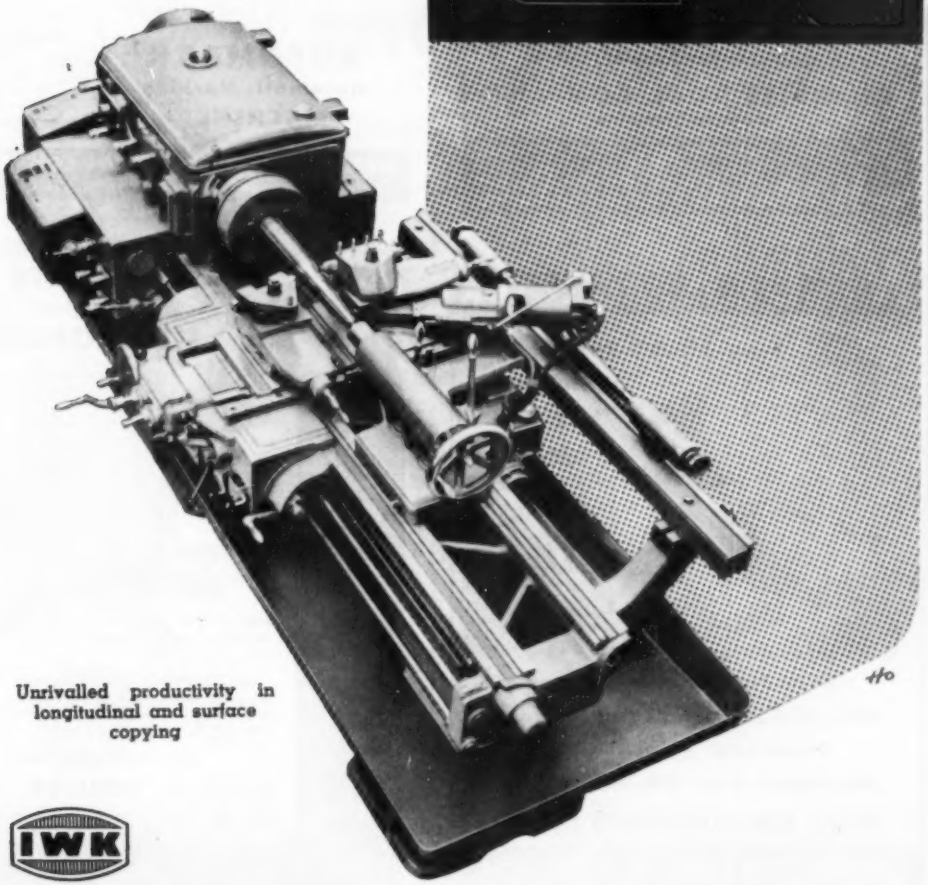

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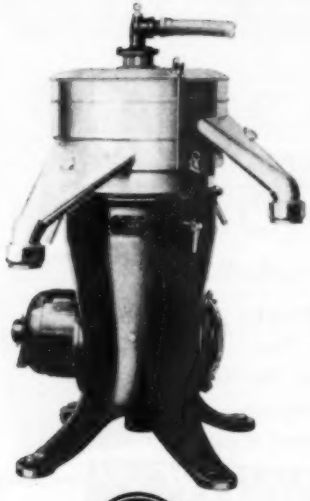

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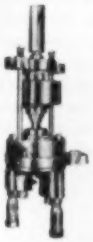
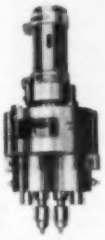


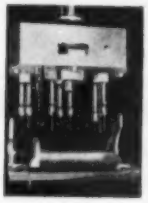
ADJUSTABLE TAPPING HEAD

Fully geared. Needle bearings on all spindles in head. Ball thrust bearings throughout. Bronze bushed. Sand cast aluminum case.



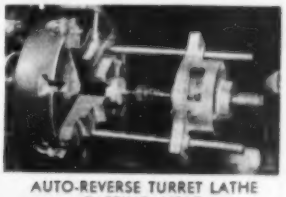
ADJUSTABLE DRILLING HEAD

This versatile tool permits you to take advantage of a wide range of adjustment without overhang.



MULTIPLE SPINDLE HEADS

Shown is a ten spindle multiple drilling head, drilling ten varied size holes on different elevations.



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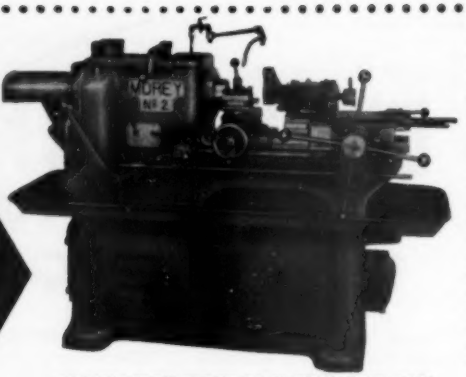

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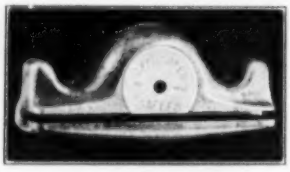

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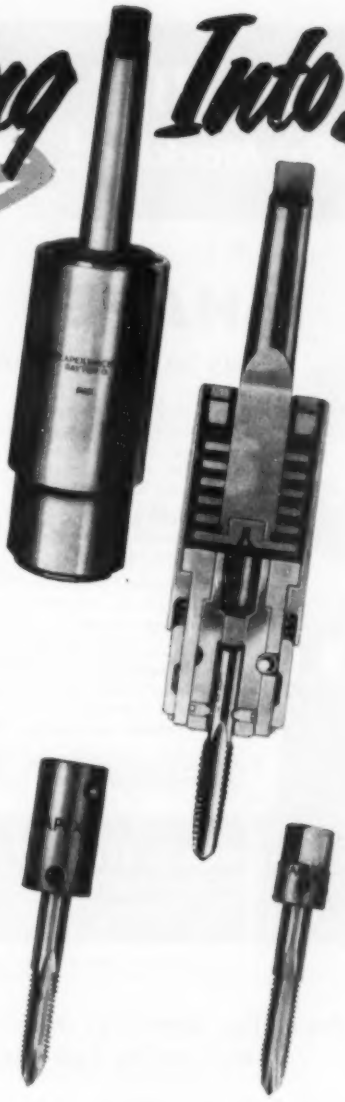

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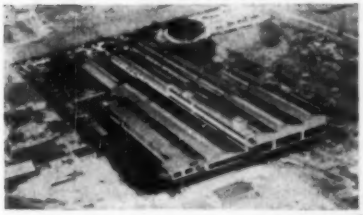

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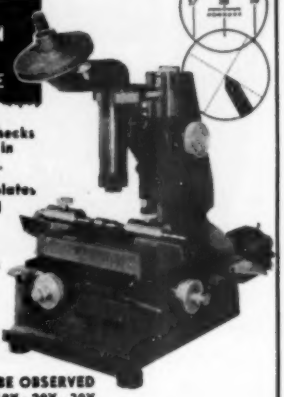

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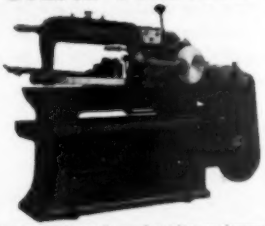

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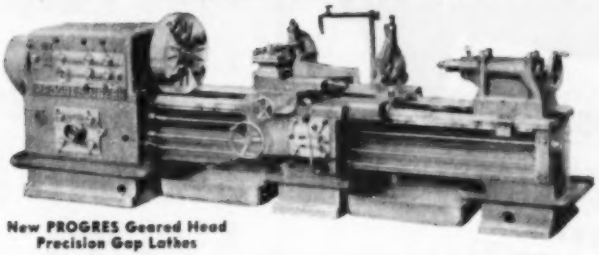

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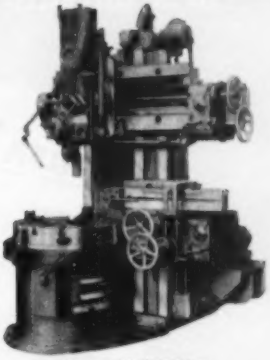

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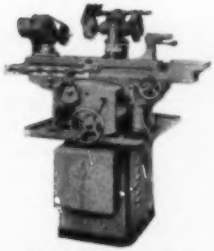

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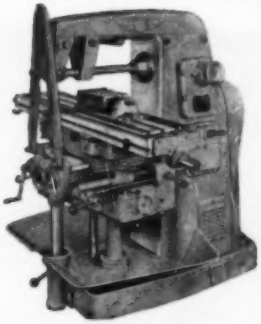

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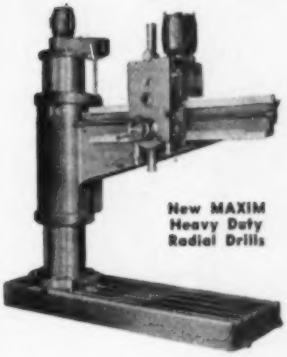

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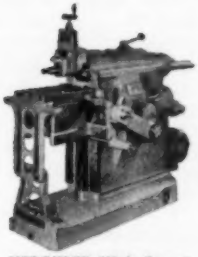

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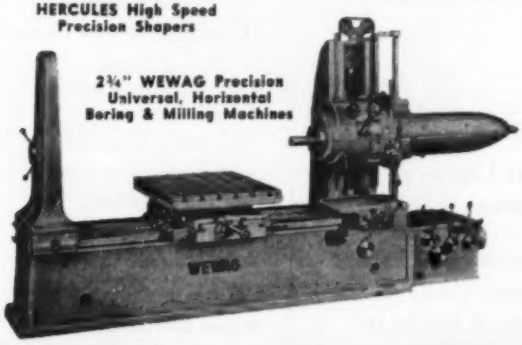

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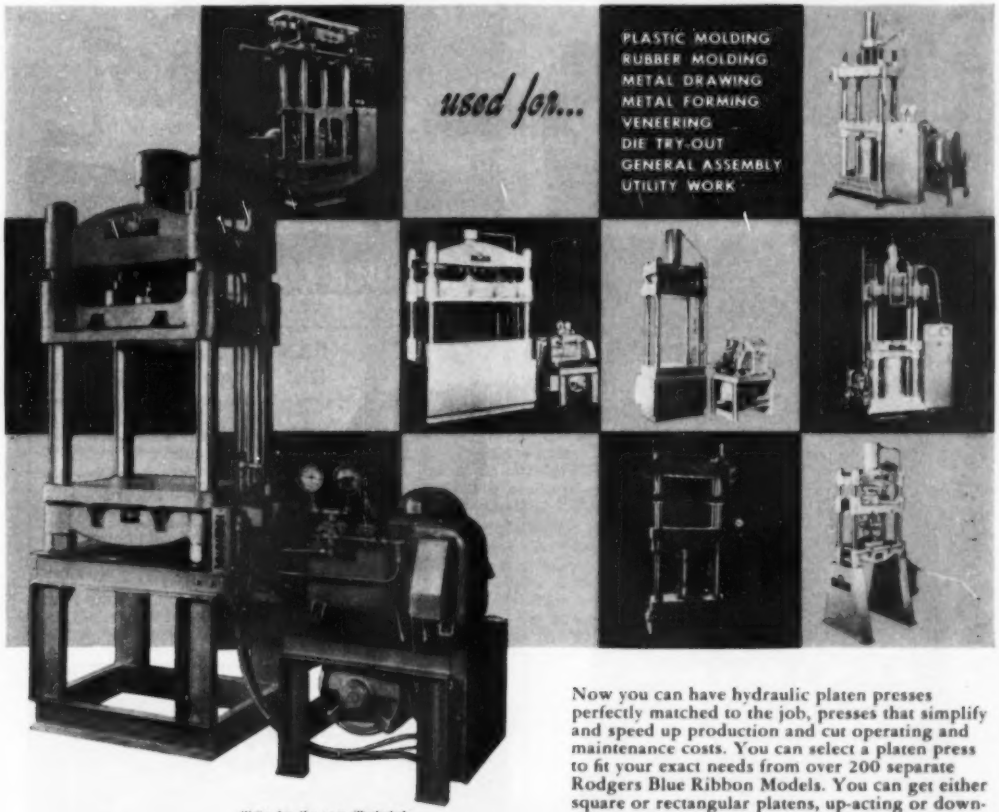

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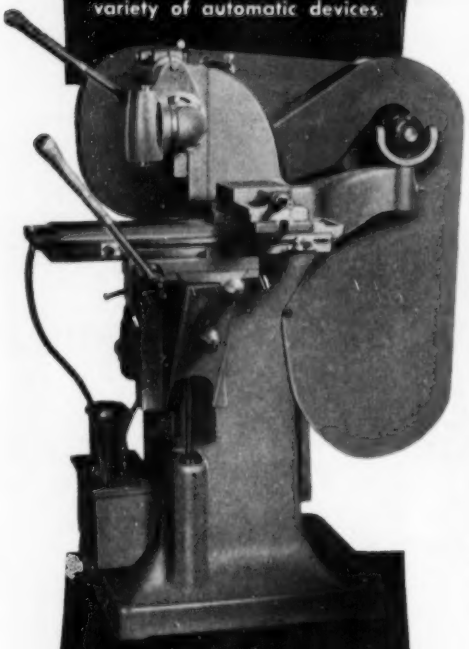

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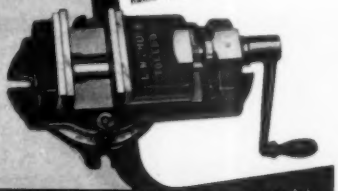

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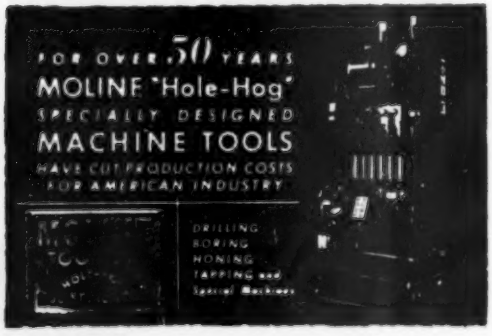
The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units so that repairs can be made easily.

This style instrument can be furnished with various dials, graduations and ranges, in both English and Metric. There is a R. & S. Gauge for practically every purpose. Write for circulars describing our complete line.

FRANK E. RANDALL CO., INC.
248 Ash St.
Waltham 54, Mass., U.S.A.
Makers of Dial Gauges Since 1896

FOR OVER 50 YEARS
MOLINE "Hole-Hog"
SPECIALLY DESIGNED
MACHINE TOOLS
HAVE CUT PRODUCTION COSTS FOR AMERICAN INDUSTRY



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(Classified Advertising)

H. E. Hilty, Mgr.

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DEPEND ON DYNAPRENE

Flexible Cord

for

ON THE JOB PERFORMANCE

There's no doubt about it, DYNAPRENE Flexible Cord is the quality flexible cord. Its performance record is outstanding because quality is built into it from the start. A special neoprene compound gives the jacket exceptional ruggedness; DYNAPRENE will withstand unusually hard wear and resists the destructive effects of oil, grease, sunlight and most acids.

DYNAPRENE is vulcanized by the continuous steam cure process. By this means accurate centering is assured, flat spots are eliminated and uniformity of jacket thickness is the result. In addition high tensile strength and unusual flexibility are built right into DYNAPRENE. It is no wonder that DYNAPRENE exceeds Underwriters' requirements for SO, SJO and SV-neoprene jacketed cordage . . . it is made that way. If you want outstanding performance be sure to specify DYNAPRENE for your flexible cord requirements.

WELL BUILT WIRES SINCE 1899

WB WHITNEY BLAKE CO.

NEW HAVEN 14, CONNECTICUT

SEARCHLIGHT SECTION

EMPLOYMENT OPPORTUNITIES EQUIPMENT USED OR RESALE BUSINESS

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Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display and advertisements.

The advertising rate is $10.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—8 columns—80 inches to a page.

SALESMEN

COMPANY

Large, well financed, progressive, respected, rapidly expanding, operating internationally.

PRODUCTS

Machine shop consumables.

LOCATION

Several available, limited travel by auto which is furnished, expenses paid.

COMPENSATION

Salary, commission, bonus, pension.

EXPERIENCE

Qualified to handle the everyday problems of a general machine shop with background such as foreman, tool engineer, etc. Grinding experience particularly desirable. Sales experience not required. Training in selling available on the job.

AGE

Not limited but in the 30's preferred.

Replies will be held in complete confidence. Give details of experience and current earnings. Our employees know of these openings.

SW-5539, AMERICAN MACHINIST
520 N. Michigan Avenue
Chicago 11, Illinois

BEVELED GEARS

Manufacturer has some available time for straight cut beveled gear work running from 1½" to 20", depending upon ratio, 4 pitch to 24 pitch. Equipped to handle coniflex or straight bevel tooth if required.

SIER-BATH GEAR & PUMP CO., INC.
9252 HUDSON BOULEVARD
NORTH BERGEN, NEW JERSEY

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them.
GENERAL PATTERN WORKS
7233 Rice Street Cincinnati, Ohio

FOR SALE

Shop, as going business. Specializing in Disc. Stamping and Turret Lathe work. Had same customers several years. Capacity about thirty men. Also seven room house on premises, 1¼ acre landscaped. Personnel will stay if desired. Location, small town in central Monmouth County N. J. Low taxes. Established 33 years. Owner wishes to retire.

BO-5824, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

PRESS BRAKES

10' x 3/16" CHICAGO DREIS-KRUMP

10' x 3/16" COLUMBIA

Late Type
Excellent Condition

WINSTON MACHINERY CO., INC.
326 WEST OHIO STREET
INDIANAPOLIS 2, INDIANA

NEW AND USED

2—Potter & Johnston auto. Turret Lathes Model 6-DREL
2—Herbert Universal Turret Lathes #9S #4
2—Bardons & Oliver Turret Lathes #7 #5
3—Cincinnati Vert. Mills #0-8
2—Girards Radial Drills 3 ft. 4 ft.
2—Double end Centering Machines 10x42
1—Jones & Lamson auto. Thread Grinder 636
1—Bryant Hole & Face Grinder 16A22
1—Kent Owens Hydr. Miller 1-8
1—Landis Hydr. Internal Grinder 15x8
1—double spdl. Profiler 15x9
1—Heald hydr. Surface Grinder 25A
1—Arter Surface Grinder A-1-8
1—Logan hydr. Press, cap. 5 ton
2—Hi-speed V-Ram Shaper 20"

MACHINE & TOOL CO.
Long Island City 1, N. Y.

SHELL LATHES

THIRTY-THREE SHELL LATHES

1944 machine equal to new. Hepburn & Williams located our warehouse Detroit. Real bargains for quick sale. *Call, write for details.*

BRADLEY MACHINERY CO.
211 Jos. Campau, Detroit 7, Mich.
LO 7-6375

LATE MODEL TOOLS

2—American Type T-6-32 Broaches Three-way vertical hydraulic, single ram, 15"x10" table. Cap. 12,000#. Gusher pump. MD with 7½ HP motor. 1942-1948

Bliss No. 28½ O.B.I. Press. 125 ton. Air cushion. 10" stroke, die space 28" x 38", shut height 24". 1951

No. 330 "Barnesdrill" Multiple Cyl. Hyd. Hone, throat—16¼", spindle stroke 2" to 20", 5" dia. spindle. Sleeves with #6 taper. 1946

R.A.VINE, Inc.
new and used machinery
652 W. Willis Ave., Detroit 1, Mich.

BEARINGS

BALL BEARINGS • ROLLER BEARINGS
ALL SIZES — ALL TYPES
WRITE OR WIRE YOUR NEEDS
NEERUP INDUSTRIAL EQUIPMENT
2137½ SOUTH WABASH AVENUE, CHICAGO 16

Executive Engineers $ to 15,000. Designers—all kinds to 12,000. Tool Designers—Engineers $ to 12,000. Detailer, Draftsmen and Trainees—Highest Pay—FREE. Employers pay our fees on the above. We also place all types of manufacturing executives, office and sales executives.

J. L. OVERHOLT, Wabash Employment Agency
202 S. State St., Chicago, Illinois

WANTED

WORLD'S LARGEST INVENTORY

NEW AND GUARANTEED REBUILT EQUIPMENT

MOTORS TRANSFORMERS GENERATORS DIESELS

WRITE, WIRE OR PHONE

ELECTRIC EQUIPMENT CO.
L. D. (Long Distance) 65
ROCHESTER 1, NEW YORK
Explosion Proof Motor Headquarters

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 43 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 388 Dun Bldg., Buffalo 3, N. Y.

MACHINERY WANTED

Highest prices paid for late type machine tools.
Write — wire — phone
J&L MACHINERY & SUPPLY CO.
7906 Mack, Detroit, Mich.

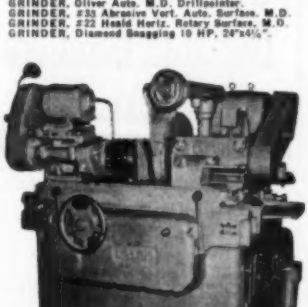
BUY FROM STOCK
Telephone
BAKER 5887

FALK
MACHINERY COMPANY

10 WARD ST.
ROCHESTER 5
N. Y.

Every Item Guaranteed as Represented

AUTOMATIC, #200 Brown & Sharpe, M.D.
AUTOMATIC, Cleveland Model #B-1½" Spl. Spdl.
AUTOMATIC, Semi #2 B & S Wire Feed, 1" screw.
BALANCER, Anderson Bros. 14"x64", Rota-Checker.
BORING MILL, 24" Bullard M.D., V.T.L.
BORING MILL, 30" Bullard M.D., V.T.L.
BORING MILL, 36"x44" Niles Vert. M.D., Side Head
BORING MILL, 48" Bullard M.D., 2 Heads
BORING MILL, 10' Cinci-Vert., M.D. 2 heads.
BORING MILL, 2¼" Lucas Horiz., M.D.
BORING MILL, Lucas Horiz. 3" Bar, M.D.
BORING MILL, Giddings & L #32 Horiz. 3½" Bar.
BARRELS, Tumbling Lapomatic, Schutte & Koerting.
BROACH, #3 LaPointe Horiz. 50" Str. M.D.
COMPRESSOR, Ingersoll Rand ER-1, 10 HP, M.D.
COMP., 15 HP, 10 HP, Gardner Denver, M.D., New.
COMPRESSOR, C-P 50 HP., M.D., 10x10, 278 CFM.
CON., 1sq.-Rand ER-1, 100 HP Syn. M.D.
CRANE, OET Ricker 2 tons 11'9" span.
CRANE, Caston #6 Portable Gooseneck 3 ton cap.
CHIP WRINGER, Barratt #251, M.D., 18" dia.
CHIP WRINGER, 20" Tolhurst M.D., Late.
GAS CUTTER, Airco #4 & #10 DB Radiagraph.
RADIAL DRILL, 3'x9" Cincinnati-Bickford, M.D.
RADIAL DRILL, 4'x11" American, M.D.
RADIAL DRILL, 5'x15" Cincinnati-Bickford, M.D.
RADIAL DRILL, 6'x15" Cincinnati-Bickford, M.D.
RADIAL DRILL, 20" Walker Turner M.D., Late.
DRILL, Fosdick 16", S.S. Power Feed, M.D.
DRILL, #2 Colburn H.D. #4 M.T., M.D.
DRILL, #121 Baker Auto., S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic #2, M.D.
DRILL, Deep Hole, Pratt Whitney #2 Gun Barrel.
DRILL, Edlund #2B, 3 spdle., #2 M.T., 10".
DRILL, 4 & 6 Sp. Avey 12" overhang, #3 M.T., M.D.
DRILL, 4 Sp. Barnes H.D., M.D. #4 M.T., P.F.
DRILL, Cincinnati 21" with Tapping Attach. M.D.
DRILL, Natco Multiple Spdle. #12, #1 M.T., M.D.
DRILL, Natco Mult. Spdle. Type 17, 10 Sp. #1 M.T.
DRILL PRESSES, Leland Gifford #1WS, 1, 2, 3, 4.
DRILL PRESS, #2MG Buffalo Forge single spindle.
DRILL, Barnes, 24" S.S., #4 M.T., 1½" cap.
DRILL PRESS, #2S Foote-Burt S.S. 24", #3 M.T.
DRILLS, #14, #15, #16, #18 Buffalo Forge, M.D.
DEEPFREEZE Motor Products 40° below zero.
DEMAGNETIZER, SB-911 Magnaflux, late type.
FACING HEADS, 20" & 24" Monmort-Dixon.
FILER, #11-B Cochrane Bly Auto Saw Filer.
FILER, #11-B Type P4, Floor Type, M.D., Thell
FURNACE, Westinghouse Elec. 18 KW, 2100° F. cap.
FURNACE, Machine Steam Oven, Serial #3343.
GRINDER, #1 Wilmarth Berman Hand Surf., 6"x12".
GRINDER, #2 Imperia Univ. Tool & Cutter, New.
GRINDER, #4 G & L Univ. Tool & Cutter, M.D.
GRINDER, Disc, Besly #205, 18" Dble. End.
GRINDER, Heald Rotary #25, M.D. 15" Cap.
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x30".
GRINDER, Thread, Jones & Lamson STG-615, Late.
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.
GRINDER, Cranfield #12 Int. Hydromatic, M.D.
GRINDER, Oliver Auto. M.D. Drillpointer.
GRINDER, #33 Abrasive Vert. Auto. Surface, M.D.
GRINDER, #22 Heald Horiz. Rotary Surface, M.D.
GRINDER, Diamond Snagging 10 HP, 24"x4½".

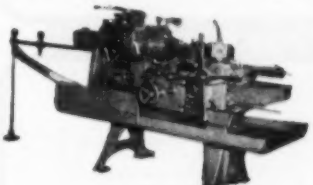


LANDIS 6 x 18 Hyd. Cyl. Grinder, Type C. Serial #29196.

GRINDER, Norton 6x18 Vert. Surface, Hyd. Late.
GRINDER, #6 & #7, Heald Internal.
GRINDER, Landis 6"x18" Hyd. Cyl. late type, M.D.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, 37" Wheel Dia. Osterbuhn Disc, 24" cap.
GRINDER, Model MG, Sanford Surf. 8"x12" cap., New.
PROFILE GRINDER, Studer Type PSM, M.D., late.
GEAR HOBBER, #3 Barber Colman, M.D.
GEAR HOBBER, 8" & 8 #34 Spur, 18" dia. M.D.
GEAR SHAPER, Fellows #6 High Speed, M.D.
GEAR SHAPER, Fellows #7 High Speed, M.D.
HAMMER, Rochester Mispeed, all sizes M.D.
HAMMER, Bradley 2000# Rubber Cushioned Helve.
HEADER, Manville #1 S.S.S.D. Cold, 3/16".
INDUCTION HEATER, 15 KVA Ecco Hi Frequency.
INDUCTION HEATER, 30 KW Lepel, Late Type.
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting, NEW.
HOIST, 5 ton capacity Shepard Electric.
HONE, #194 Barnes Vertical, M.D., Hyd. Late.
KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
LAPPER, 29" Norton Vert., M.D., late type.

DISC GRINDERS

Osterbuhn 37" Wheel Diameter Disc Grinder. 40 HP. TEFC 3/60/440 spindle motor drive. 24" capacity.



#4 WARNER & SWASEY Geared Head Turret Lathe, Motor Driven, Bar Feed, Taper Attachment.

LATHE, La-Swing 8"x108", M.D., A.C. Rebuilt.
LATHE, Porter-Cable 9"x15" Geared Head Prod.
LATHE, 12"x18" Lips Carbe, Late Type, M.D.
LATHE, Hendey 12"x5' G.C.G. Taper Attach. M.D.
LATHE, LeBlond 14"x6', G.C.G. M.D.
LATHE, Hendey 14"x8' G.C.G. Taper Attach. M.D.
LATHE, Lodge & Shipley 16"x5', G.C.G., Grd. Hd.
LATHE, American 16"x6' G.C.G., Grd. Hd. M.D.
LATHE, Lehman 18"x7' G.C.G., M.D.
LATHE, American 18"x10' G.C.G., Grd. Hd.
LATHE, South Bend 18/36"x8' Gap Bed, G.C.G. M.D.
LATHE, Hendey 20"x10' G.C.G., Taper Att. M.D.
LATHE, Reed-Prentice 20"x10' Grd. Hd. M.D.
LATHE, LeBlond 22"x10' G.C.G., M.D.
LATHE, 24"x12' Boye & Emmes Geared Head, T.A., Late.
LATHE, Putnam 24/32"x12' G.C.G., M.D.
LATHE, LeBlond 24"x14' G.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', G.C.G., M.D.
LATHE, McCabe 20/48"x10' Double Spindle Lathe.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, Bridgeford 32"x16' G.C.G., Grd. Hd.
LATHE, Buffing Dble. End #VBTS, Davies Bros.
LATHE, Turret #1 Bardons & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret, #4 Warner & Swasey Univ. 1½".
LATHE, Turret, #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #2 Cinci. Acme Univ. Geared Head.
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
LIFT TRUCKS, Baker 1 & 2 ton, Platform & Fork.
MILL #4 Burke Motor Driven, Late, M.D.
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #14 Garvin Plain Horiz., M.D.
MILL, #2Y Brown & Sharpe Plain Horiz., M.D.
MILLING MACHINE, #2B K & T Horiz., M.D.
MILL, Cinc. Horiz. #3, #4, #5 High Power, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #0-S Cinc. Vert. Prod. Late, M.D.
MULT-MILLER, U.S. Tool #MM-1-6, Auto. Prod.
MILL, #0 Versco Hand Mill, M.D. Late.

No. 700 ESPEN LUCAS Hydraulic Heavy Duty Cut-off Saw, new 1945.

MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILL, #2 Cinc. Univ. Horiz., M.D.
MILLING MACHINE, LeBlond #4 Horiz. Univ.
MILL, #2 Vert. M.D. Brown & Sharpe.
MILL, #4 Cinci. Vertical Hi Prow., M.D.
MILL, #5C Becker Vert. Die Sinker, M.D.
MILLING MACHINE, #2 Van Norman Duplex, M.D.
MOTOR GENERATOR SET, Gen. Electric, 100 K.W.
NIBBLER, Grey Turret Type ¼"x28" cap. M.D.
OZALID Model "F" Whiteprint Machine, Late.
THREADING, Staybolt Lamiter Milltwinland 1½".
THREAD MILL, 7½x11 Hanson-Whitney, Univ.
THREAD MILL 6x14 Pratt & Whitney No. 1100.
THREAD MILLER, Lees-Bradner #48A Automatic.
THREAD MILLER, Pins-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late.
PAPER SHREDDER, No. 10 Mitts & Merrill, M.D.
PLANER, 24"x24"x8' Cincinnati, M.D.
PLANER, Cincinnati 30"x30"x12' A.C., M.D.
POWER PRESS, Bliss #104 Open Back, M.D.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 50"x36" Bed Area, M.D.
POWER PRESS—Bliss-Openslidetted #182-B Straight Side Dble. Crank 45 tons, M.D.
PRESS, #148 Toledo Toggle Drawing, M.D.
PRESS, 135 ton Clearing Single Crank 9" Str., Late.
PRESS, 75N Drake Hydraulic Arbor, New.
PRESS, #78½ Bliss S.S. 9½ Str. M.D.
PRESS, Federal #2 O.B.I. Grd. 2" Str.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS, Toledo 39½ S.S. 440 ton cap. 6" str.
PRESS, Waterbury-Farrel High Speed 60 tons #5W.
PRESS, 60C Bliss Double Action, 3 crank.
WHEEL PRESS, Chambersburg 400 tons cap. Hyd.
PRESS, Lucas 15 tons Power Arbor M.D.
PRESS, #60 Whitney Deep Thr. 24", Inst.
PRESS, P2, P3 Ferracute M.D. Roll feed.
PANTOGRAPH, #1A Gorton M.D. Engraving
PUNCH, #46 Buffalo Forge Vert. Cap. 1"x½" M.D.
PUNCH, R-41-P Windsmans Turret, 14 stat. 24" thr.
PUNCH, Hasker Turret, 9 station, cap. 2½" hole.
PUNCH, H & J #2 Spio. End. 24" Thr. 1" thru 1"
PUNCH, H & J #3 Spio end. 48" Thr. 2" thru 1½".
RIVET SETTER, ¼" cap. Pneu. Tubular Rivet.
ROLLS, Bertsch Pyramid 10'x1¼" cap., M.D., Late.
ROLLS, #1 Buffalo Forge Wrapping, M.D.
ROUTER, #W340D, Onsrud, Electric M.D.
COLD SAW, Wagner 10"x10" cap., M.D.
COLD SAW, Espen-Lucas #700, 48" dia. blade, M.D
CUT-OFF SAW, Yates-American #M-90, M.D.
SAW, #4B Marvel Hack Saw 6"x6" Cap., M.D.
SAW, #6 Marvel Band 18"x18" cap., M.D.
SAW, #302 Campbell Abrasive Cut-off, M.D.
SAW, #30-C Racine Shear Cut 6"x9" cap., M.D.
SAW, Band, Tannewitz & GH-30" High Speed, M.D.
SHAPER, 18" Pratt & Whitney Crank, M.D.
SHAPER, 28" Rockford Univ. M.D., Tilting Table.
SHAPER, G & E 24", high duty, back geared, M.D.
SHAPER, 32" Cinci. S.C., Motor driven, M.D.
SHAPER, Morton 30" Draw-Cut, 4-Speed, M.D.
SHEAR, #642 Niagara 42"x¼" cap., 19" gap., M.D.
SHEAR, #26 Buffalo Forge Slitting Armor Plate.
SHEAR, Quickwork 3-1 Rotary 60° Throat, 18 ga.
SHEAR, #8E Niagara M.D. 8"x3/16" cap. M.D.
SCREW SLOTTER, #2 Waterbury Farrel Auto. M.D.
SLOTTER, 12" New Haven Vertical, M.D.
SPEED CUTTER, Milwaukee 56 tons, 2½ cap. M.D.
SURFACE PLATES & TABLES, all sizes.
TAPPER, #1 CAM Haskins, Motor Driven, Late.
TAPPER, #1 Bakewell (Warner & Swasey) Late.
WELDER, 500 amp. Westinghouse Flexarc A.C.
WELDER, 200 & 400 amps. Gen. Elec. Portable Arc.
WELDER, 200 KVA Federal, Projection.
WELDER, 75 KVA Federal, M.D., Spot.
WIRE STITCHER, Morrison and Acme, M.D.

OVER 2000 MACHINE TOOLS AVAILABLE IN STOCK

WHY SEARCH?

WE CAN SUPPLY YOU WITH ALL YOUR MACHINE TOOL NEEDS

OVER 30 YEARS EXPERIENCE

AUTOMATICS

11¼" 8 Spindle Conomatic
14"x33" Fay automatic lathe
5/16" No. 00G Brown & Sharpe
8" 6-spindle Bullard mult-au-matic. Type A
8" 6-spindle Baird Timken bearing chucker, front and rear slides, late type

BORING MACHINES

3" bar Lucas table type
4" Detrick & Harvey horizontal, floor type.
72" Niles Bement Pond, older style
American Fdy. & Mach. Co. vertical precision

BROACHES

2-ton American Model HO horizontal hydraulic
No. 3XA Oilgear horizontal hydraulic
No. 1 Foote Burt duplex vertical surface
No. V 42 American hydraulic, 18 ton capacity
No. VU 12 LaPointe vertical hydraulic internal

DRILLS

20" Colburn No. 2 Heavy duty
11-Spindle No. 1 Baush multiple
22-Spindle No. 16 Natco multiple
30-Spindle No. 2 Baush multiple
34-Spindle No. A16 Natco multiple
No. 27 Fox vertical hydraulic multiple

COMPLETE MACHINERY SERVICE

GEAR MACHINERY

12" No. 12 Barber Colman hobbers
12" No. 12H G & E universal hobbers
16" Cincinnati hobbers
24" No. 3 Adams Farwell hobber
60" No. 5 Brown & Sharpe cutter
72" Schuchardt & Sihutte universal hobber
72" Westinghouse universal hobber
Nos. 1 & 5A Lees Bradner hobbers
No. 130 Cleveland "Rigidhobber"
4" Glesso aspiral bevel generator

GRINDERS

No. 2 Cincinnati centerless
6"x30" Cincinnati Filmatic cylindrical
10"x18" Norton type C
23", No. 22B Hanchett opposed disc
30", No. 84A Gardner opposed disc.
Nos. 5, 16-28 & 24-36 Bryant internal
No. 72 Heald Gagematic & Sizematic
12"-16" No. 22 Heald rotary surface
6"x18" Doall hydraulic surface
No. 2 Brown & Sharpe universal

MONEY BACK GUARANTEE

MILLERS

No. 2 Cincinnati plain, motorized
No. 3 LeBlond plain, motorized
No. 3B Kearney & Trecker, SPD
12" & 18" Cincinnati Manufacturing
24" Cincinnati automatic duplex
4-36 Cincinnati hydromatic bed type
30", 42", & 84" rotary continuous (Newton & Ingersoll)
No. 31 Devlieg supermil
4" No. M80 Taylor & Fenn spline
8"x16" Hanson Whitney thread
No. CT 36 Lees Bradner thread

PLANERS, SHAPERS & SLOTTERS

30"x30"x10' Cincinnati, box table
36"x36"x8' American, double housing
36"x36"x8' Cleveland 05, one rail, one side head
36"x36"x10' Niles, AC motor drive
26" Smith & Mills back geared shaper, motorized
26" Worcester heavy duty shaper
26" Morton draw cut shaper
32" Ohio "Dreadnaught," motor drive shaper
36" Niles traveling head shaper
10" Betts slotter
12" & 16" Bement slotter
24" Niles Bement Pond slotter

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BORING MILLS

Giddings & Lewis #90T Horizontal Boring Mill—3" bar—Table cross travel 24"—Spindle speeds 30 to 2000 RPM—MD—1946 machine—Like new.
Bullard 24" "Spiral Drive" Vertical Turret Lathe—Side head—3-jaw chuck table—Coolant tank, pump and piping—MD—Late type
Bullard 42" and 54" "Spiral Drive" Vertical Turret Lathes—4-jaw chuck table—Side heads—MD

DRILLS—RADIAL

American 4'13"—32 speed head—Tumbler gear box—MD
Fondick 5'14"—18" spindle traverse—Box table—Tumbler gear box—MD
Cincinnati-Bickford 7'22" Master Type—Box table—Straight base—24 speed head—AC MD

GEAR CUTTERS

(5) Barber-Colman #3 Standard—High speed hob swivels—Lever operated collets—Lever operated overarm supports—MD—Late type
(4) Mikron #102 Universal—Cap. to 4.00" dia. x 4.5" long—MD—Coolant

GRINDERS

Cincinnati 6"x30" Model EA Plain Hydraulic—Saddle type—Filmatic bearings—4-motor drive—1949 machine
Heald #72A Internal Universal—Swing 28"—Max. dia. ground 11"—Sizing bracket—MD—1945 machine
Blanchard #16 Rotary Surface—30" chuck—Recti-Sur—MD
Norton #2 Universal Tool & Cutter—Combination attch—Internal spindle—MD—1942—machine
Cincinnati #2 Centerless—Through feed work rest—Hydraulic wheel dresser—MD

PLANERS

Gray 30"x36"x8' Openside—1 roll & 1 side head—Helical gear drive—Table working surface 98½" x32"—MD
Betts 72"x72"x24' Double Housing—Power rapid traverse—2 roll & 2 side heads—Reversible MD

SCREW MACHINES

New Britain #80 6-spindle—Cap. 1"x3"—Chip conveyor—Large ass't tooling—MD—Late type
S. A. J. Petermann Model P7 Single Spindle—Cap. 9/32" dia.—Tooling—MD

MISCELLANEOUS

Berlech 18'x14" cap. Pyramid Bending Roll—100 HP main drive and 50 HP elevating motors—1944 machine—Excellent condition
Bullard 30"x20" Man-Au-Trol Spacer Unit—Hydraulic—Adapter plate—Measuring tools—Late type

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3 SHERMAN ST. WORCESTER MASS.

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#84 Fellows Gear Shaper, Ser. #38113
#84A Fellows Gear Shaper, Ser. #29634
6' American Radial Drill, Ser. #55092
Ledge & Shipley Lathe #2900L—18" jaw chuck
Reed Prentice Engine Lathe
60" Nasebett Face Grinder
6D Potter & Johnston Automatic Chucking Machine
10" Gould & Eberhardt Shaper, Ser. #867A7
Cincinnati #3 Miller—Ser. A1004-B
5' Reed Prentice Radial Drill—Serial #5121
Geared Pin Rector, Serial #2525
Rowbottom Cam Miller and Motor Serial #135/40 rebuilt and guaranteed
#32 Lucas Precision Horizontal Boring Mill Serial #32-10-51
#72A Heald Sizematic Internal Grinder Serial #24480
20" Knight Rotary table—Motor Driven

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ULTRALAP Model 10 Vert. Lapper

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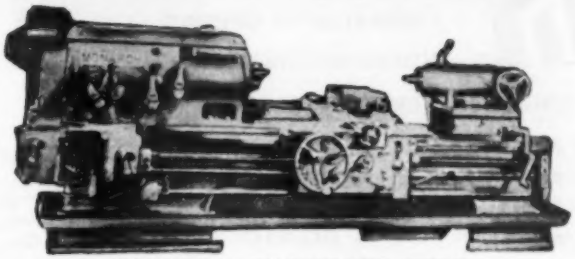
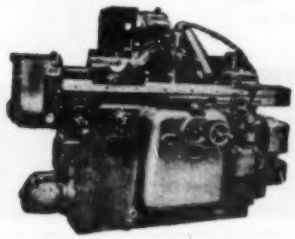
SOUTH BEND 10"x4' G.C.G. Engine Lathe 1" Cap.
MONARCH Model EE 10"x20" Toolroom
NEW LOGAN 11"x36" CC 1" Cap.
MONARCH Model N G.H. Engine Lathe 33½"x120" cc
LODGE & SHIPLEY G.H. Engine Lathe 24"-27"x16' cc
AMERICAN G.H. Engine Lathe 24"-27"x96" cc
AXELSON G.H. 24-Sp. Engine Lathe 10"x54" cc
LEHMANN G.H. 16-Sp. Engine Lathe 18"-20"x52" cc
AMERICAN G.H. Engine Lathe 18"-18½"x30" cc
MONARCH Model ST Multi-Tool Mfg. Lathe 12"x10" cc
HARDINGE 2nd Operation Lathe 1" Cap.
CARROLL-JAMIESON 16"x8' G.H. 12-Speed Lathe



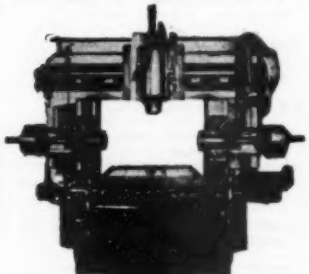
MONARCH 33½" x 120" ENGINE LATHE—MODEL N



JONES & LAMSON MODEL TG 12 x 45" AUTOMATIC THREAD GRINDER

TURRET LATHES

WARNER & SWASEY Mod. 2 G.H. Ram Type 1" Cap.
WARNER & SWASEY Mod 2 G.H. Ram Type 1½" Cap.
BARDONS & OLIVER Mod 2 G.H. Ram Type 1" Cap.
BARDONS & OLIVER Mod 3 G.H. Ram Type 1½" Cap.
WARNER & SWASEY Mod 3 G.H. Ram Type 1½ Cap.
GISHOLT Mod 3 G.H. Ram Type 1½" Cap.
LIBBY Mod 4R G.H. Ram Type 2" Cap.
BARDONS & OLIVER Mod 5 G.H. Ram Type 2" Cap.
WARNER & SWASEY Mod 5 G.H. Ram Type 2½" Cap.
GISHOLT Mod 5 G.H. Ram Type 2½" Cap.
FOSTER Mod 1B Univ. G.H. Saddle Type 2-8 1/16" Cap



P&W 40" VERTICAL MILLER AND PROFILER—WITH TWO SIDE HEADS

AUTOMATICS

BROWN & SHARPE Model 00G ⅜" Cap.
CLEVELAND Model A Single Spindle 9/16" Cap.
CLEVELAND Model A Single Spindle 1-1/16" Cap.
CLEVELAND Model A 1½" Cap.
CLEVELAND Model B Single Spindle 1½"—1⅝" Cap.

BORE-MATICS

EXCELLO Model 2112A Single End Double Spindle Hyd. Cross Slide Table
HEALD Model 48A

DRILLS

NEW G. M. S. R. Type T.B. 2 Radial 4'x12" Column
NEW ZEWO Universal Floor Type Radial 21"x½"
NEW CAMEDY OTTO 18" Single Spindle ¾" Cap.
NEW FAMCO 15" Bench Type Drill Presses ½" Cap
NEW FAMCO 15" Floor Type Drill Presses ½" Cap.
MORRIS MOR-SPEED RADIAL 3'x8" Column
LELAND GIFFORD 2 Spindle

GEAR EQUIPMENT

BARBER-COLMAN Type 5 Gear Hobber
FELLOWS 3" Fine Pitch Shaper
GLEASON 12" Straight Bevel Generator—Finisher—Roughet
GLEASON 3" Straight Bevel Generator
GLEASON 3" Spiral Bevel Gear Generator
GLEASON 3" Bevel Gear Tester
GLEASON Model 9 Angular Hypoid Tester
GLEASON 10" Spiral Bevel Generator
BARBER-COLMAN Model 12 Hobber 12" Cap.
BARBER-COLMAN No. 3 Precision Hobber

GRINDERS

BROWN & SHARPE Model 2 Internal-External Universal Grinder 14"x30" Cap.
CINCINNATI Univ. Hydr. Cyl. Int.-Ext. Grinder 12"x 10" Cap.
NORTON Model C Hydr. Plain Cyl. Grinder 8"x30" Cap.
THOMPSON Model F Hydr. Surface Grinder 8"x18" Cap.
ROTOREX Model 101-A Universal T & C Grinder, w/Int. Att.
COVEL Model 91A Univ. T & C Grinder
JONES & LAMSON Model TG-12x45" Auto. Thread Grinder
EXCELLO Model 35 Thread Grinder
EXCELLO Model 51 Thread Grinder

MILLING MACHINES (Horizontal)

VAN NORMAN Model 3B Ram Type Duplex
VAN NORMAN Model 22L Ram Type Duplex
NEW CENTEC Model 2A Universal With Vert. Att.
BROWN & SHARPE Model 3B Heavy Plain
MILWAUKEE Mod 3B Plain
MILWAUKEE No. 1-B Universal Miller
SUNDSTRAND Rigidmil Bed Type Production
BROWN & SHARPE Mod 10 Auto. Production Miller
CINCINNATI Mod 00 Plain Horiz. Auto., Cycle

MILLING MACHINES (Thread)

PRATT & WHITNEY Model C-M-1896 Thread Miller 4½"x36"
HANSON & WHITNEY Univ. Semi-Auto. Thread Miller 10"x48"

MISCELLANEOUS

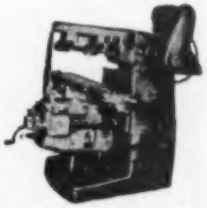
FAMCO #6, 8, 10, 12, 15 Foot Presses (NEW)
EXCELSIOR #6, 8, 10, 12, 15 Foot Presses (NEW)
ARBOR PRESSES (NEW)

VERTICAL MILLERS AND JIG BORERS

KNIGHT Model 3B Univ. Vert. Miller
MILWAUKEE Model 2 Vertical Miller
BROWN & SHARPE Model 2 Vertical Light Type Miller
GORTON Model 8D Super Speed Vertical Miller
CLEVELAND Model 1 Vertical Miller

PRESSES

WIEDEMANN Model R11P 18 Sts. Power Turret Punch
RUESCH #2 Percussion Press



NO. 36 VAN NORMAN MILLING MACHINES

PROFILERS

PRATT & WHITNEY 48-inch Profiler 2 Side Heads
PRATT & WHITNEY 30" Single Spindle

SHAPERS

HENDEY Universal H.S. Crank Shaper 12"
GOULD & EBERHARDT Industrial Shaper 30"

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COLUMBIA 92"x¼" Cap. 18" Gap Power Shear
PEXTO 44" Geared Power Shear
NIAGARA Model 412 Power Shear 12'x16 Gauge

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BAKEWELL Model 2 Tapper ⅜"—2½" Cap.

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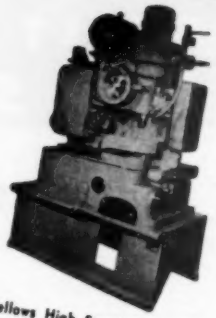

Type #7 Fellows High Speed Gear Shaper suitable for both spur and helical internal and external gears.

Reconditioned, fully guaranteed.

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LATE MODEL MACHINE TOOLS . .

AUTOMATIC SCREW MACHINES
No. RA-8 0/1⅝" Acme Gridley. 1942
No. RA-4 1¼" Acme Gridley. 1943
2" Model A Cleveland. 1942
1 1/16" Model "A" Cleveland. 1943

DRILLS, RADIAL
3'9" Cincinnati Bickford. 1942
3'11" Archdale Radial (English). 1947

GEAR EQUIPMENT
No. 7 Gleason "Revert" Rougher. 1943
No. 6 Gleason Revacycle Generator. 1940
No. 72 Fellows H.S. Gear Shaper. 1942
10" Pratt & Whitney Hyd. Gear Grinder. 1942
Red Ring Universal Gear Checker. 1942
20M Fellows Red Liner Gear Tester. 1942

GRINDERS, CYLINDRICAL
16"x72" Norton Plain Type "C". 1941
16/20x36" Norton Plain Type "C". 1942
14"x168" Norton Plain Type "C". 1942
12"x60" Fitchburg Plain Hyd. 1942
10"x18" Landis Plain Type "C". 1940

GRINDERS, INTERNAL
No. 77A3 Heald Plain Hydraulic. 1942
No. 24-36 Bryant Hydraulic. 1943
No. 18 CP 18 Bryant Hydraulic. 1942
No. 18-18 Bryant Hydraulic. 1942
No. 172 Heald Hydraulic Gap. 1940

GRINDERS, RADIUS
No. 73 Van Norman Radius Grinder. 1943

GRINDERS, SURFACE
No. 22 Heald Rotary 22" chuck. 1944

GUN BARREL MACHINES
No. ½-8x50 Pratt & Whitney Rifler. 1942
No. ½-8x50 Pratt & Whitney Reamer. 1942
No. ½-8x30 Pratt & Whitney Reamer. 1942

LATHES, ENGINES
38"x200" American Geared Head. M.D.
22"x102" Niles "Timesaver" Lathe. 1941
22"x120" Lodge & Shipley Gap Lathe. 1940
22"x80" Niles "Timesaver" Lathe. 1940
20"x180" Betts Bridgeford Lathe. 1940
20"x90" Betts Bridgeford Lathe. 1940
25"x120" Gisholt Schofield. New
14"x30" Bradford. 1942

LATHES, PRODUCTION
No. 3FU Foster Pantermatic Platen Type. 1942
No. 5D Potter & Johnston Automatic. 1943
No. 4D Potter & Johnston Automatic. 1942
8"x24" Lo-Swing Semi-Auto. 1941
Lipe-Carbo-Matic Lathe. 1942

LATHES, TURRET
No. 1L Gisholt Universal Saddle Type. 1942
No. 3R Gisholt Universal Saddle Type. 1943
No. 4R Gisholt Universal Saddle Type. 1943
No. M5 Libby Universal Saddle Type. 1939
No. 5W Acme Universal Way Type. 1942
No. 5 Gisholt Universal Ram Type. 1942
No. 3 Gisholt Universal Ram Type. 1942
No. 4R Libby Universal Ram Type. 1942
No. 6R Denver Universal Ram Type. 1942
No. 3R Libby Universal Ram Type. 1947

MILLS
No. 3 Van Norman Plain. 1942
No. 2K Milwaukee Plain. 1941
No. 4B Milwaukee Plain. M.D.
No. 3 Cincinnati Vertical. M.D.
No. 2G Kempsmith Universal. 1947
No. I-16 Cincinnati Auto. 1941
No. M-16 Milwaukee Auto. 1943
ALS Ahlers Plain Mill (No. 2 Size). New
No. 2 Rapid Universal Mill. New
FPN 2B Mathey Vertical Mill. New

MISCELLANEOUS
20000 HP Midwest Dynamometer. 1942
75 HP Gardner Denver Air Compressor. 1943

PLANERS AND SHAPERS
28" Ariston Shaper. New
24" Gernotti. New
24" Invicta Shaper. New
21" Ariston Shaper. New
18" Invicta Shaper. New

PRESSES
850 Ton Verson Double Action Eccentric. 1940

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MUST MOVE PROMPTLY FROM LOCAL CUSTOMER'S PLANT

BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.

GOULD & EBERHARD 36" Gear Cutter M.D.

BROWN & SHARPE #5—48" Gear Cutter, M.D.

BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 35"x64". Quantity of boring bars.

GRAY 36"x36"x8' Planer, 2 heads on cross rail; motor driven. Thoroughly rebuilt and guaranteed.

B & O #2 Turret Lathe 1" Cap. M.D.

FOOTE-BURT #2B—24" Heavy duty Vert. Drill #5 M.T. Motorized.

GRINDERS—CYLINDRICAL. B & S #11, 7"x 32". Plain Grinder. Table swivels. Motorized with 4 motors.

LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".

"BEMENT" 26" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram 2 tables (PLANER SHAPER)

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THE OSBORNE & SEXTON MACHINERY CO.

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Bullard 24" V.T.L., Spiral Drive
Cleveland 2½" Bar Cap.
Giddings & Lewis No. 32, 3" cap.
King 42", 72" Vert. 2 rail heads
Niles-Bement-Pond 4", 4½" Bar, 60" Vert
Niles-Bement-Pond 60" Vert.
New 3" Hor. Bor. Mills

DRILLS AND RADIALS

American 6'x15" Univ.
Bausch Multi-spindle
Buffalo #2 Motor Spindle
Canedy-Otto 21" Sliding head New
Cincinnati Bickford 6'x15" cal.
Natco #12 20 spindle drill, Bausch
24" Sibley Sliding head
New Geared Box Col. Drills 24'
Foote-Burt #25 3" cap.
Leland Gifford 2 LMS 3 MS

NEW VERTICAL MILL

ENGRAVERS

Deckel type 3 Dim., New
Gorton 3S Die Sinker
Gorton 3Z
Gorton #1A, ME, Deckel G1L
Taylor-Hobson 3 dim.

GEAR EQUIPMENT

Barber-Colman #2, #12 (3), Flather 72" Cutter
Fellows High Speed Shapers 712, 725, 71
Fellows #20M Redliner
Flather 72" Cutter
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
Michigan Gear Finisher 24" cap., 862-24-A
National Broach Red Ring Lapper
Schochardt & Shutte #1 Hobber

GRINDERS, MISCELLANEOUS

Bryant #5, Internal, chucking, 16A16
Cincinnati 6x18" Cyl. Hyd.
Greenly Models 1G1 & 1G2
Heald #73 Internal Centerless, Sizematic
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic
Landis 6"x30" Type C Cyl., 10x24 Univ.
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 6"x30", 10"x18" Type C cyl.
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 30"x28'
Oliver #510 Drill Pointer
Sellers 6T Tool, K.O. Lee tool
Van Norman #666 Crankshaft
Wicaco Internal

NEW IN STOCK

Air Hydraulic Presses — Arbor Presses 56C Famco — Band Saws Kalamazoo — Famco 6x12"—Drill Presses all sizes—Hydraulic Press Northern 20 Ton — Injection Molders, 1 ounce — Power Presses, OBI, 1, 4, 4½, 5, 7½, 10, 15, 20, 30, 55, 85 ton—Shaper 7" Amco, 8" Shaperite — Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power 3'x18 gauge to 10' x 10 ga.—Welders, Arc, Seam, Spot all sizes Motors, Grinders, Buffers.

AUTOMATIC SCREW MACHINES

Brown & Sharpe (12) Model 0G, serial No's. 9680 & 10708 series, 3/8" capacity.
Brown & Sharpe (7) Model 00G, serial No's. 14, 15, 16000 series, 3/4" capacity.
Brown & Sharpe (4) Model 2G, serial No's. 8500 & 11500 series, 1 1/16" capacity.
Cleveland, Model AA-11, Serial #36586.
Cleveland, Model B, Serial #42618/843, 1-1/16" capacity.
Conomatic 4 Spindle, Serial 2309FF, 1½" capacity.
New Britain Gridley 61 6 Spindle, Serial No. 25410, 1 9/16" capacity.

GRINDERS, SURFACE

New 8x24" Hyd. Feed, 10x18"
Abrasive 8x24", #33 Vert. & #34
Blanchard #16, 36" Mag. Chuck
Heald 22—12" chuck, Arbor 12"
Norton 6x18" Hyd
Portman 12" Chuck Rotary
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base, 2A 6x18
Tuft Pierce #1 Precision

LATHES

American 14"x38
Bridgeford 34"x20', 32"x16'
Handey 12"x42" and 12x30", 1941, 16x66"
Handey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed, 19x42"
Lipe-Carbo 12"x18" (2)
Lodge & Shipley #3A, #3 Duomatics
Pratt & Whitney 16"x60—Late
New 16, 18, 29", 28" Immediate Del.
Reid Small Piece #9WSL
Rivett Model 918 Precision
Sebastian 12"x4' G.H., Sheldon 12"
Sundstrand 8x15", 15" Stub
Wickes 32"x35' Geared Head

MILLS, PLAIN, UNIV. PROD.

Brand New Universal Mills No. 1, No. 2
Archdale Plain, 14", Production
Brown & Sharpe #3B Plain, Late, 3A, 21, #2L
Cinn. No. 3, 4 Plain Spd., 18" Manufacturing
Kent Owens 1V, 1-B, 1-14, 1M
Kempsmith #1 Pl.,Vert. & Div. Hd.
Milwaukee 2K, 2H Univ., 2H Plain.
Milwaukee #2B, Plain & Univ.
Sundstrand #00, 0, Rigidmils
Sundstrand #2A Rigidmill with copying Attach, 33
Van Norman #2L Univ.

MILLS, VERTICAL

Brand New Vertical Mills
Cincinnati #3, #4 hi-power, #4 Dial Type
Cincinnati 00 Vertical
Morey #12M Profiler, 2 sp.
Pratt & Whitney Profiler 12B, 2 sp

PRESSES

Bliss 645, 650 Hi-Production Presses
Bliss 18, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton SS, Bliss 74½
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
Bliss 5-48 Dbl. 32x48" bed, Cashion
Toledo 92½c Dbl. Crank 43x23" bed
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Niagara Herring, 15 Ton
Niagara A1¾, O.B.I.
Toledo 29 Double Action Cam
V & O #102 O.B.I. Reducing
Welsh No. 3 O.B.I. 23 Ton, U #1

TURRET LATHES

Acme 6W Fox 2-9/16" Cap. #2 Cross Slid Turret
Bardons & Oliver #2, 3, 5, 7
Brown & Sharpe, #2 Hand, #10, 11
Denver 4 2" Shell Turret (2)
Foster #2B 2½" Cap. Morey #2G Late
Gisholt 2L, Cross Slid. Tur. #5 Bar Feed, Chuck
Gisholt Simplimatic
Jones & Lamson #5, Bar Feed
Morey #2G Late
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1A, Timken Head
Warner & Swasey #1, 2, #4 Pressetector

MISCELLANEOUS

Automatic B & S #90G, 0G, 2G
Automatic 4 Sp. 1½ Conomatic
Automatic; New Britain 61 6 Sp. 1 9/16" Late
Automatic, Cleveland Model B 1-1/16", A
Band Saw: DoAll Zephyr 36", 16" Metalmaster
Bolt & Pipe Threader: Landis, Oster-Williams #915 Pipe & Nipple Threader
Broach: 3L LaPointe Hydro. Horiz. New Kliak. 6 Ton
Hacksaw: Peerless 6"x6"
Hone: Micromatic H-4
Keymaster Davis, Baker
Oil Groover: WICACO
Shapers: 24" Rockford, 24", 28" Gould & Eberhardt, Cinn. 20, 24"
Shears Power: George Obi 10' 3/16", 10' x 14 gauge, 11' 14 gauge
Welder: 50 KVA Eisler Air Operated, New Seam
Welder: Taylor-Winfield 50 KVA Hi-Wave

New Lathes 16" to 28", Mills, Boring Mills, Broaches, Shears & Presses

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SELF CONTAINED PRESSES

150 Ton Triple Action HPM Press
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
8 and 9 oz. Injection Moulders

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300 Ton Watson Stillman 28"x20" Platen 8" St. 19" opening

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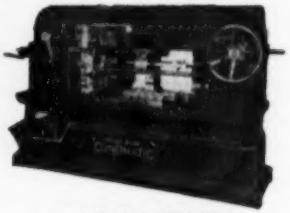
Cleve. Model B, 1-1/16" cap., late
2½" Cone, 4 spdle., well equipped, 1936
#24 New Britain 4 spdle. chucker, 2½" cap.
¾" Model F Gridley, 4 spdle.



2" 4 SPINDLE CONEMATIC

BORING MILLS
42" Bullard New Era, side and rail head
60" Bullard, 2 rail heads, all p.f.
No. 40 Landis floor type, 4" bar, rebuilt

GRINDERS
No. 5 B & 5 cylindrical, 3x12" late
#33 Excello ext. groove, late type
#86—30" Gardner vert. disc grinder
14x36" Norton C semi-auto., cyl.
73 Heald Internal Centerless
73 Heald Internal, 1944, like new
#76RA Rogers knife grinder, 76"
P & W deep hole drill grinder, late
Oliver single point tool
Model 1311 P & W contour, late

#106 Rivett Internal
5 HP Marschke, single end

DRILLS
No. 3 Allen sgle. spdle., No. 4 M.T., p.f.
#2LMS Leland Gifford 4 spdle., hand feed
6'17" Carlton radial, DC motor, late
4'11" Western radial, enclosed head
#12 Minster r., #5 M.T., box column
#2LMS Leland-Gifford, 26", hydraulic
#24 Footburt, 3 spdle., #5 M.T., 24"
#2 Allen, 2, 4, 6 spdle., #2 M.T.
36" Synder single, #5 M.T.
#2 Detroit Semi-automatic, horiz.
Type 14 Natco 12 spindle
Model 4230 Boding Drill & Tapper, 12 sta.
Moline Hole Hog, 2 spindle

GEAR MACHINERY
#13LS Fellows lapper
7A Fellows, shaper, high speed, hvy dty
61A Fellows, shaper, high spood precision

LATHES & TURRETS
24x102" Reed-Prentice, g.b., quick change
27"x13' LeBlond, g.b., 16 speeds, late
27"x17' Niles, g.b., taper, late
30"x8' Betts Bridgeford, taper, late
30"x10' American geared head, taper att.
33" Niles vertical wheel, 1930
48" Niles vertical wheel, 1930
#3 Morey Universal, air chuck, late
#2 Simmons Microspeed
#4 W&S, sorial 327317
Hepburn Shell
Gisholt Simplimatic, platen type
40"x35' centers LeBlond Heavy Duty, geared head, 1940.

SHAPERS & PLANERS
30"x30"x17' Cleve. Openside
48x48x14' Detrick & Harvey dble. hsg.
26" Smith & Mills shaper, 4 step cone

MILLS
#1½B K & T horiz., dbel. overarm, rebuilt
Briggs production, hydraulic
10C Van Norman Contour

THREADERS
#50 Excello Precision grinder, 28x68"
TG185 J & L Internal grinder, 12 x 15"
13" Automatic Machinery miller, late
Model 40 Lees Bradner mill, 6½" hole
#2 Dalzen grinder, 3" o.d. cap., late
LT636 Lees Bradner mill, 18 x 36", late
1½" Landis, 2 spdle., loo dscrew type

FURNACES
Whiting Converter, 2 ton cap., late
Model SP Juthe, gas, 1000° F
Lithdraw heat treat, 1290° F, late

PRESSES
50 ton Henry & Wright Dicing
#12 Zeh & Hahnemann percussion, 150 ton
#3 Koehler OBI, 18 ton, 2" stroke
#78½ Bliss straight side, 35 0ton, sgle. crank
Ferracute type EG-52 embossing, 150 ton
Lucas 50 ton straightening, 24½" stroke
#57 Toledo, 150 ton, s.s., s.c.
#4 Toledo OBI, 25 ton, 2" stroke
#2½ Niagara OBI, 45 ton, 2½" stroke
100 ton Niles wheel press

MISCELLANEOUS
SAW: #18 Marvel hack, 18 x 18", late
HAMMER: 4000# Erie Steam, sgle. frame, late
KEYSEATER: #26-38 Mitts & Merrill, 4 x 36"
SPINNING RIVETER: Grant 5 spdle.
LAPPERS: 86-36" Gardner, vert. spdle
HAMMER: 300# Bradley Upright Helve
WELDERS: Hobaart and P & H Arc, 400 amp.
BULLDOZERS: #2 Ajax High Speed, 30 ton

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Rivett No. 104 A.C. M.D. Internal Grinder.
Milwaukee Nos. 2-B & 3-B Horiz. Plain Millers D.O.
Cincinnati 30"x36"x10' D.H. Planer 2 Hds. Box Table.
Heald No. 72A-3 Hydr. Int. Grinder Rod Head Sp.
LeBlond 27"x12' Rod Grd. Hd. Q.C.G. Lathe 15" bullow spindle.
Norton 8x18" Horiz. Hand Surf. Grinder 1941.
Cincinnati No. 2 Hi-Power S.P.D. Vert. Miller.
G & L 3" Bar Horiz. Boring Mill.
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Campbell No. 213 abrasive cut off 1947.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1947.
Nazel #3-B Vert. Air Hammer A.C. M.D.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 18"x8' bed Q.C.G. Lathe 1955.
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G & E 24" Gear Box Shaper Tilt. Table Top.
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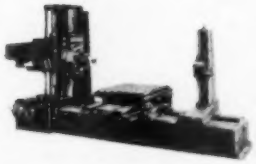

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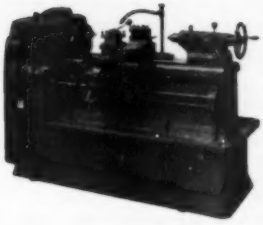

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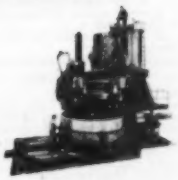
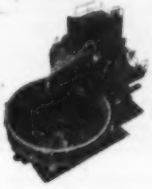
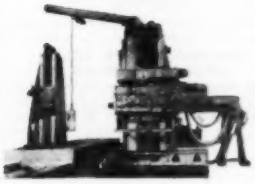


BERTHIEZ TYPE 9040

The Berthiez Type 9040 Machine with turning capacity to 23 feet. One picture shows the sliding rotary table extended, the other picture shows the table close to the column. This unique design gives our machine a greater rigidity than that of any of the double upright machines. Machine pictured available for October 1952 delivery.





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Cleveland 4 Spindle 5½" Chucker Model M
Gosa & DeLeeuw 4 Spindle 8½"x8" Plain Chucking Tool Rotating—(2) (Late)
New Britain S.S. 5¼" #146 (Late)
New Britain 6 Spindle 1⅝"x7" Model #206

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American 40 Ton 40" Str. VPU 4-Station (Latest)
Colonial 1 Ton 12" Stroke Model VJ1-1-12 (Late)
Oliver 6 Ton 36" Stroke Horizontal Model X812

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Bullard 42" Vertical New Era Type Side Head
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Rogers 36" Vertical, 1 Turret Head and 1 Side Head (Latest)

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Kingsbury Auxiliary Drill Heads 60" Circular Base with Coolant
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GEAR EQUIPMENT
Brown & Sharpe #3-26 Gear Cutter
DeLaval Gear Reducer
Gould & Eberhardt 24"x12" Gear Hobber

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Abrasive 8"x24" Surf. Gr. #34 Vertical Spindle
Arter 16" Rotary Surface
Brown & Sharpe #4 Universal 14"x60"
Bryant Internal Grinder Model 16F2B (Late)
Heald 12" Rotary #22 Surface (Late)
Heald #50 Cylinder Grinder
Heald #72A5 Plain Extended Bridge Internal (Latest)
Landis 6"x18" Plain Hydraulic Type "C" (Late)
Landis 6"x20" Plain Hydraulic Type "A"
Van Norman #666—20"x48" Crankshaft Re-Grinder (Late)
Ro #2 New Universal Tool & Cutter Grinder (New)
Cincinnati 10x18 Plain Hydraulic (1946)

LATHES
Acme #6 Turret Lathe
Foster #2B 22" Swing Turret Lathe
Gisholt #1L 2½ Capacity Turret Lathe
Gisholt #3AL Saddle Type Turret
Moray 26" Bar Feed Turret (Late)
Betts-Bridgeford 36"x12" B.C. Engine Lathe
Lodge & Shipley 20"x112" B.C. Engine Lathe
Bridgeford 27x8' CC (Late)
Fay 20"x55" Automatic (1945)
Sundstrand 8"x15" Production Lathe (1942)

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Berkley Horizontal B-186
Brown & Sharpe #4A Universal
Hanson Whitney Thread Mill 11" Swing Internal and External Capacity
Ingersoll 28"x33" Table Horiz. Slab Mill
Ingersoll 42"x24"x8' Planer Type Mill One Side Head and One Head on Rail
Kent-Owens #1-8 Hydraulic (1943)
Sundstrand #4-5 Rigidmill 22"x72" Table
Ur2 Superindumatic #2 Universal (New)

PLANERS
Detrick & Harvey 4' Open Side
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Henry & Wright 50 Ton Dieing Press
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Toledo 90 Ton #82C Double Crank Back 2" Str.
Williams & White #13 Combination Punch & Shear

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Betts 18" Vertical Shaper
Gould & Eberhardt 24" V-Ram with shaper vise, motor driven

MISCELLANEOUS
Pexto-Wilcox 14 Gauge x 96" (Late)
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Simplex Centering Mach. 5" Max. Cap. 18" Swing (Late)
Tocco 50 KW 2-Station Unit with Starter, 10,000 cycle (Late)
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60"x20' NILES BEMENT POND Geared Head Engine Lathe, rapid traverse

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24"x72" centers Boye & Emmes heavy duty G.H. Engine Lathe, chuck, A.C., m.d.

No. 3 GISHOLT Turret Lathe, 5-1/16" hole in spindle, bar feed, chucks, tooling, new 1943

No. 2B FOSTER Geared Head Turret Lathe, rapid traverse, AC motors

42" BULLARD Vertical Turret Lathe, New Era type, AC—MD

36" BULLARD Spiral Drive Vertical Turret Lathe, AC—MD, rebuilt

No. 3-24 Cincinnati Plain Hydromatic Mill

No. 1 DOUGLAS Plain Horizontal Mill, table 8"x32", power feeds, motor in base, Timken spindle, No. 40 taper, new 1942

#2 Van Norman Plain Mill, New 1942.

5'-13" column CARLTON Radial Drill, AC motor on arm, 15-1500 RPM, box table

4' AMERICAN High Speed Sensitive Radial Drill, 9" column, AC motor on arm

No. 6 TOLEDO O.B.I. Press, 36 Tons

23A HEALD Rotary Surface Grinder, 24" diameter, magnetic chuck

18"x24" Norton Surface Grinder, New 1943.

36" OHIO Dreadnaught Shaper, AC—MD

1½" LANDIS Bolt Threader, leadscrews, AC—MD

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2—Engine Lathe, 12"x40" centers. Gap.

1—Engine Lathe, 16"x60" centers, Taper attach. Gap.

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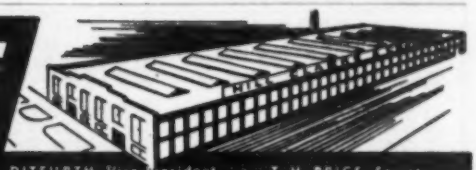

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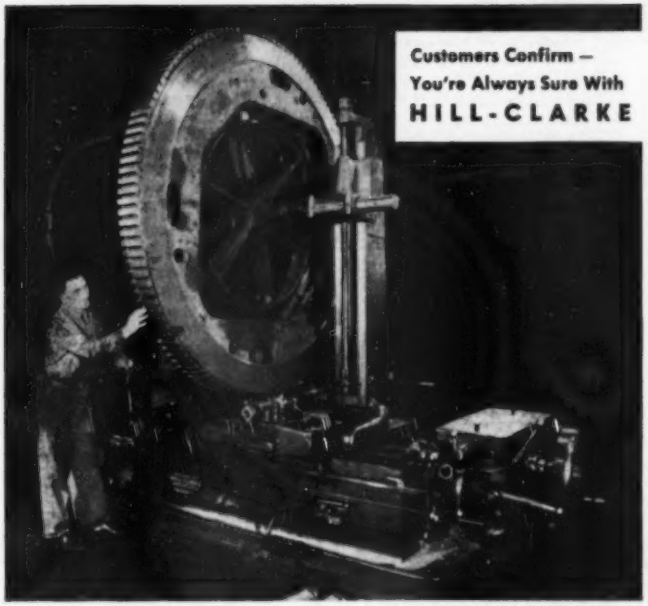

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AUTOMATICS

⅞" G Model Gridley
1-1/16" Model A Cleveland (1942)
1½" Foote Burt (1941)

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No. 45—4½" bar Giddings & Lewis Hor. Bar
72" Niles—Vert. Bor. Hvy. Pattern

DRILLS

1 Spdl—15" Sw—No. 2 Avey, Cam Fd.
1—Spdl—24" Sw—No. 2 MA6 Avey
2 Spdl—24" Sw—No. 2 Aveymatic
2 Spdl—24" Sw—No. 3 Avey
4 Spdl—20" Sw—No. 2 LMS—L.G.
D-31 Fox Multiple Drill, No. 2 Taper.
6' Western Radial

GEAR MACHINES

No. 12-H Gould & Eberhardt Hobber
No. 12HS Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
28" Gleason Bevel Gear Generator
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl. Rougher
No. 612-A Fellows Gear Shaper
No. 615-A Fellows Gear Shaper
No. 65 Fellows—Cone Dr.
8" cap Red Ring Gear Lapper

GRINDERS

6"x18" Norton Cylindrical (1943)
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
14"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
24"-32" Gap x 144" centers
No. 4—12"x60" B&S Univ. Gd.
No. A-3—12" Arter Rotary Surf.
5A Bryant Internal
5B Bryant Internal
No. 16-16 Bryant Internal Grd.
No. 16-26 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 74 Heald Internal Centerless
No. 44 Excello Carbide Tool Gdr.

LATHES

19"x8' LeBlond Hvy. Duty Lathe
36"x18' Putnam Grd. Hd., M.D.
No. 4R Libby Turret (1942)
No. 4 Warner & Swasey Tur.-Bar Fd.
5W Acme Ram type Tur., 2" Capacity

LATHES *(continued)*

No. 6 Warner & Swasey Tur.-Bar Fd.
18" Libby Tur. Lathe, M.D.
No. 3AL Gisholt
No. 4A Warner & Swasey—7⅛" Hole—Spdl.

MILLING MACHINES

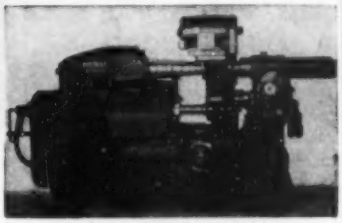
No. 1 Kempsmith Plain Mill
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney (1942)
12"x102" Lees Bradner Thrd. Mill

PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 hds.
42"x42"x10' Cincinnati, 2 hds.
48"x36"x14' Gray, 2 hds.
48"x48"x12' Cincinnati, 2 hds.
48"x48"x12' Gray Maxi-Service
60"x48"x27' American, 4 hds.

MISCELLANEOUS

2—12"x96" Magnetic Chucks
20'x1" cap Southwark Roll
14'x⅝" cap Niles-B-Pond Roll
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
No. 0 Bakewell Tapper
No. 200 Micro. Horiz. Hone, 1 Spdl.



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No. 0 G&L Horizontal Boring, Drilling and Milling Machine
Nos. 31 & 32 LUCAS Horizontal Boring, Drilling and Milling Machine
36" BULLARD Vertical Turret Lathe
100" BETTS Vertical Boring Mill

DRILLS

3'9" CINCINNATI BICKFORD Hi Spd Radial, '41
32" CINCINNATI BICKFORD Upright Drill
No. ES NATCO Multi. SpindleDrill—Hyd. table, '42
No. 42S BAKER S.S. Heavy Duty Drill
No. 2MS LELAND GIFFORD 4-spindle Drill

GEAR EQUIPMENT

Nos. 04, 72 & 72SA FELLOWS High Speed Gear Shapers
No. 12 FELLOWS Gear Shaver, 1943
No. 16SM GOULD & EBERHARDT Gear Roughers

GRINDERS

No. 5 B&S 3"x12" Plain Grinder
6"x18" CINCINNATI Plain Hyd. Cyl.—Filmatic
6"x18" LANDIS Type C Plain Grinder
6"x18" CINCINNATI Pl. Saddle Type Grinder
6"x18" NORTON Vertical Spindle Surface Grinder
10"x24" LANDIS Universal Grinder
10"x72" LANDIS Type C Hyd. Pl. Grinder—'42
No. 104 RIVETT Internal-External Grinder
No. 73 HEALD Internal Centerless Grinders
No. 172 HEALD Internal Grinder

LATHES

12"x36" MONARCH Toolmaker's Lathe
13"x16" MONARCH "Air Gage Tracer" Mono-Matic Lathe
14"x6' HENDEY Model ECM M.D. Engine Lathe
16"x30" LODGE & SHIPLEY Toolroom Lathe, '41
20"x10' LODGE & SHIPLEY Selective Geared Head
27"x14' on LEBLOND HD Engine Lathe, '42
30"x16' bed AMERICAN "High Duty" Geared Hd.
36"x18' bed AMERICAN ND Lathe
42"x15' AMERICAN Geared Head Lathe
42"x25' oc AMERICAN "Super Productive" GH Lathe—two carriages

MILLERS

Nos. 0-0 CINCINNATI Plain & Vert. Milling Mach.
Nos. 1-8 & 1-12 KENT OWENS M.D. Production Millers
Model MM-5 U.S. Multi-Miller
No. 2 B&S Pl. Light Type Miller
No. 2 CINCINNATI Vertical Millers, 1941
16" CINCINNATI Mfg. Knee Type Milling Mach.
4½x30" PAW Model C Thread Miller
30"x30"x10' INGERSOLL Planer Type, 3 heads
36"x36"x12' INGERSOLL Planer Type, 3 heads, Late

AUTO LATHES & TURRETS

No. 2 B&S Wire Feed Hand Screw Machine
No. 2 W&S Geared Friction Hd. Turret Lathe
No. 3 B&O Ram Type Universal Turret Lathe
No. 3 J&L Ram Type Universal Turret Lathe
No. 1MS LIBBY Heavy Duty Turret Lathe
No. 1L GISHOLT Saddle Type Turret Lathe, 1942
Nos. 4D & 6B POTTER & JOHNSTON Auto.

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203 BENT ST. CAMBRIDGE 41, MASS. KIRKLAND 7-5242

AUTOMATIC, #00G B. & S., 1950
AUTOMATIC, 1½" 4 spin. Gridley Model G
BOLT THREADERS, 1½" Williams Reliance
BOLT THREADER, 2" Landis, 2 Hds., M.D.
BORING MILL, 100" Cinci. Massive, 2 Hds., M.D.
BORING MILL, 72" King, 2 Hds., P.R.T., M.D.
BORING MILL, 5" bar Betts Floor Type, with 5'x10' plate
BORING MACH. 3" Bar Lucas & Lambert (2)
BORING MILL, 3½ Bar Giddings & Lewis #8
DRILLS, RADIAL, 4' Western, M.D. (2)
6' Amer. 15" col. Trip. Purp., M-on-arm
5' Amer. 13" col. Trip. Purp. M-on-arm
5' Niles #10 Rightline, Univ., Motor on arm
5' Amer. 14" col. Trip. Purp.
4'11" col. Cinci. Bickford
3'8" & 2½", new (Swedish)
TABLES, RADIAL, 30"x20"x20"
DRILLS, 24" Cinci. Bick., Tapping, M.D.
#80 Colburn 36", 5' capty.
#314 Baker, 24", 3" capty.
#2 LMS Leland Gifford deep hole.
FLANGERS, ¾"x½" McCabe (2)
GEAR HOBBERS, No. 36M Gould & Eberhardt
GEAR PLANERS, 11" Rinnecker Bevel
GEAR SHAPERS, Nos. 6, 44A, 64 & 61A
GEAR SHAPER, No. 75 Fellows
GEAR CUTTER, Nos. 11 B. & S. Spur & Bevel
GEAR CUTTERS, 60" Brown & Sharpe #6 spur
GRINDER, FACE, 84" Builders, 40 h.p.
GRINDER, Micro Internal, large capty.
GRINDER, No. 75A Heald Internal
GRINDER, SURFACE 14"x36" P. & W.
GRINDER, No. 6T Sellers Tool 1942
HAMMER, 1000 lb. Chambersburg Pneumatic, 1947
KEYSEATER, No. 3½ Baker, 24" Str. x 4" wide
LATHES, 48"x20' bed, Amer. T.A. Grd. Hd.
26", 48"x24' Bed McCabe Dble. Spin., M.D.
26"x12' Bed Bridgeford, Grd. Hd., M.D. (2)
32"x14' bed Shumacher Boys T.A., M.D.
24"x12' bed B. & E., T.A., Grd. Hd.
16-32"x8' Harrington Gap M.D.
18"x10' bed L. & S. Selective Grd. Hd., M.D.
16"x6' & 12"x8' Handeys (2)
14"x30" oac. Monarch T.A., 10½" sw.
14"x6' bed, Amer. T.A., M-in-base
TURRET LA., 21" Asma Universal Brass, late
TURRET LA., 18" Libby Model A Grd. Hd.
No. 2B Foster Univ., 1¼" capty., Bar Timken
No. 1B Foster Univ., 2" capty. M.D.
No. 00L Oster 1½", New
No. 1AL Gisholt, 6"-9½" H.S.
No. 3 Gisholt, '42
THREAD MILLER, 12"x60" Morey Shields '42
MILLER, No. 0 Sundstrand Rigidmil, Hand
MILLER, No. 1½B H. & T. Univ., Grd. Hd.
MILLER, No. 3 Cinci. HI Power, Motorized
MILLER, No. 4 Cinci. Univ. HI Power, M.D.
MILLER, No. 30H Sundstrand Rigidmil, 33" feed
MILLER, No. 2 Van Norman Ram, M.D.
MILLER, No. 22L Van Norman, Late
PIPE THREADER, 2" Landis, Grd. Hd., M.D.
PRESS, 60 Ton Henry & Wright Dieing
PRESS, 73½ Bliss S.S., 6" stroke
PRESS, No. 56 Toledo S.S., Grd., 171 ton capty.
PRESS, #3C Bliss 30" "Stiles," late
SHAPERS, 32", 28", 20" & 16", G. & E.
SHAPER, 24" Kelly, M.D., Late
SLOTTER, 22" Betts, 40" Table, M.D.

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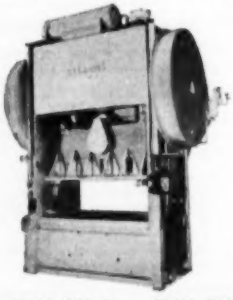

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Drilling, Boring and Reaming Machine.
Serial No. 4966—New in February, 1943
Complete with 15 HP, 1200 RPM Motor and controls arranged for 440 Volt., 3 Phase, 60 Cycle Current.
This machine is equipped with quick change transmission giving 8 spindle speeds; 65—87—124—165—243—322—462 & 612 RPM. The feed is controlled hydraulically from 1 to 11 inches per minute and has a dwell feature for facing.

SPECIFICATIONS

Capacity, High Speed Drills in SAE #1035 Steel—3" Swing—24 inches
Distance, Face of Column to Center of Table—12½ inches.
Size of Regular Table, Working Surface—32"x 19"
Vertical Travel of Spindle—18 inches.
Vertical Travel of Table—23 inches.
Spindle Morse Taper, #5
Floor Space—40"x63¾"
Weight, net, with motor—6000 lbs.

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1 used RANDEL BROACHING & BURNISHING MACHINE—completely automatic—hopper feed and air clamps—hydraulic—2 HP, 220V, 3 ph Motor—designed to produce 1000 pieces per hour.

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CAM MILLERS

VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CUTTER & TOOL GRINDERS

FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), automatic indexing

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
PRATT & WHITNEY: ½B x 50 Deep Hole Reaming Machine

GEAR CUTTING MACHINES

BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
CLEVELAND: Model 130 Gear Hobber (like new)
CLEVELAND: Model 140 Gear Hobber (like new)
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Spur Gears and Splines

GEAR FINISHERS & TESTERS

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 4 and No. 6 Bevel Gear Testers, Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
LIDKOPING: Centerless (New)
NORTON: 10"x36" plain, hydraulic
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE

GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed

GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
BRYANT: 16C16 Hole, Hydraulic
HEALD: 72A3 Sizematic Centerless

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #639, capacity 7"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—SURFACE

ARTER: A-1—8" Rotary
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck
THOMPSON: Surface Grinder, Hydraulic 24"x48" (New 1952)

GRINDERS—THREAD

EXCELLO: #31 External, dia. 5"x18"

HONING MACHINES

BARNES: No. 306H Vertical 24" Stroke
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia.

LAPPING MACHINES

FELLOWS: 8LSI and 13 LSI Gear Lappers, external and internal spur and helical
NORTON: 2Fx40" dia., for flat work
NORTON: No. 26 Hyprolaps, for flat work & Cylindrical lapping.

LATHES—PRODUCTION

BLOUNT: Polishing speed lathe 12" dia. x 48" centers
Reinecker Relieving Lathe (new)
H.E.B.: High production hydraulic duplicating and copying lathes (new)
LE BLOND: Regal, 15" swing x 42" centers
LODGE & SHIPLEY: #3A Duomatic, 25½" swing x 27" centers
PROGRESS: Geared head 16" to 30" swing (New)
TRIPLEX: 14" dia. x 40" centers Toolroom Lathes (new)
VDF New Engine Lathe 49" swing x 20' centers
VDF New Engine Lathe 27" swing x 23' centers

LATHES—TURRET

WARNER & SWASEY 2A Turret Lathe
WARNER & SWASEY #3 Turret Lathe
HERBERT: #2, #4, and #8 Sizes (new)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)

MILLING MACHINES

CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables of 36" dia.
TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

PRESSES

Gen. FLEX: Screw Press, 3 ton

SAWS & CUT-OFF MACHINES

CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)

SHAPERS

HERCULES: 16" & 22" Shapers (New)
KLOPP: 16" to 26½" Shapers (New)

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: 40A Thread Miller
MURCHEY: #22 Horizontal threading and tapping machine, ½" to 2½" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

WIRE FORMING MACHINES

BAIRD: 4-slide wire former.
HEENAN & FROUDE: Wire forming, 4-slide machines (new)

MISCELLANEOUS

CUT-OFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½ & 9½" cut-off saws with auto. stock feed (new) hydraulic
PRESS: Screw, Gen. Flex. 3 ton
TEST STAND: Denison 918-AM Hyd.
LATHES: Blount Polishing Speed Lathe, 12" dia. x 48" centers
GOGAN BRINELL Hardness Tester Model 16-J
SHAPERS: Klopp 16 to 26½" (New)
SHAPERS: Hercules 16" & 22" (New)
WIRE FORMING MACHINES: 4-slides (new)

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(4) Jackson-Melling Crank Pin Turning Lathes with 40 H.P. Motors and Pot-Type double drive chucks. Used on 6 cylinder Crankshaft. Late type.

CRANK SHAFT CENTERING MACHINES

(2) Snyder, Double End 4 Station Crankshaft End turning Machine for Machining Ends of Crankshafts. Hydraulic units self-contained. Late.

CRANK SHAFT DRILLING MACHINES

(3) Snyder, Vertical Power-Feed Drilling Machines with Cam-Lead and Movable table, for drilling Oil Holes in Crankshaft. Late type.

PISTON HOLE DRILL

Special 8 spindle horizontal drilling machine with center fixture for drilling 8 holes simultaneously in Piston skirts. Air Hydraulic Drills.

PISTON HOLE GROOVER AND CHAMFERING MACHINE

Baird, 4 station Piston Hole Chamfering and Grooving Machine for production operations on Pistons. Automatic indexing.

MAIN BEARING BORING AND MILLING

W. F. & John Barnes 5 Station Automatic Hydraulic Machine for Finishing Bore of Main Bearing and Facing of Block end on 8 Cylinder Block. Thru feed with automatic positioning. Tunnel type machine.

CONNECTING ROD STUD MACHINE

Greenlee, 6 Station Automatic Indexing Stud turning, finishing and Threading Machine. 2 Rods at each fixture, 4 working heads at each fixture.

VALVE SEAT GRINDER

Hall-Toledo, 8 Spindle Valve Seat Grinding Machine for V-8 Block automatic cycle for production Grinding or Rebuilding of V-8 Motors.

CONNECTING ROD MACHINE

Snyder, 20 Spindle Machine for drilling and Countersinking Cotter-Pin holes in connecting rod. Late type.

BUSHING PRESS

Automatic Bushing Press for pressing bushing into Main Block of Motor, 4 bushings assembled in-line. Hydraulic lifting of Motor Block.

OIL GROOVE GRINDER

Robinson, Oil Groove Grinding Machine with Hydraulic in-feed and camlead for grinding front oil-groove on Crankshaft. 1946 Machine.

MOTOR BLOCK MILLING MACHINES

Ingersoll, 8 Spindle Drum-Type Mill for cylinder heads with adjustable spindle and Worm-Drive. Also, NEWTON 96" Table type Cylinder Block Milling Machine with Rough and Finish spindles.

BALANCING MACHINE

Model No. 3-S Gisholt Dynetric Balancer for Crank Shafts. 1946 Machine.

BROACHING MACHINES

V-32 and V-12, V-1 American Pull Broaching Machines. Hydraulic. Late.

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ENGINE AND PRODUCTION LATHES

1—12" x 30" centers, Model CK MONARCH Tool Makers lathe, taper attach. Collet Chuck, 3 and 4 Jaw Chucks, New 1943.
1—14" x 84" centers MONARCH Tool Room Lathe, geared head, new 1939/40, taper attachment
1—unused MEID 17" x 78" centers Heavy Duty Engine Lathe, new 1951.
1—30" x 14' bed AMERICAN TOOL WORKS Heavy Duty Engine Lathe, taper attachment
24—No. 8 SUNDSTRAND Automatic Lathes, new 1942/1944, 8" x 21" capacity.
7—No. 4 GISHOLT Second Operation Production Forming, Facing and Cut-off Lathes, new in 1947/48; with front and rear slides, hydraulic chucking, spindle hole 4½".
2—20" x 25" FAY Automatic Lathes, 1939/40.
1—Model U SENECA FALLS LO-SWING 14" x 24" Automatic Lathe, new in 1940.

TURRET LATHES

2—#4R LIBBEY Univ. Ram type, for chuck work.
1—#7 BARDONS & OLIVER Univ. Ram type, for bar work 2½" cap.
1—Model No. 4H-8 LIBBY Heavy Duty Saddle type Turret Lathe, new in 1940, 8⅛" hole thru spindle, 32" swing.
1—1 FU Foster "Fastermatic" automatic, 1942

VERTICAL TURRET LATHES

1—36" BULLARD spiral drive, new 1940.
1—42" BULLARD spiral drive, 1940

AUTOMATICS

Several Model A 9/16" and 1-1/16" CLEVELAND single spindle.
1—Model B 1½" CLEVELAND Single Spindle Automatic, new 1943.

MILLING MACHINES

1—Model 3VG High Speed REED PRENTICE Vertical Mill and Die Sinker, new 1940.

CYLINDRICAL GRINDERS

1—10" x 18" NORTON type "C" Plain Grinder, 1942; with mechanical table traverse.
1—12" x 36" Type LC Norton Universal Grinder, new 1941
14"x36" Type CD NORTON plain, 1941
1—14" x 48" CINCINNATI Self-contained Plain Grinder, 1940; with filmatic bearings.

INTERNAL GRINDERS

Several—No. 5B, No. 16 & No. 24 BRYANT Internal Grinders.
1—Model No. 72A-5 HEALD Precision Toolroom Internal Grinder, 1942; with cross sliding headstock.
2—No. 172 HEALD Hydraulic Internal Gap Grinders; new 1941/42; cross sliding and swivel workhead, swing in gap 40".

SHAPING MACHINES

1—32" GOULD & EBERHARDT heavy duty Shaper.

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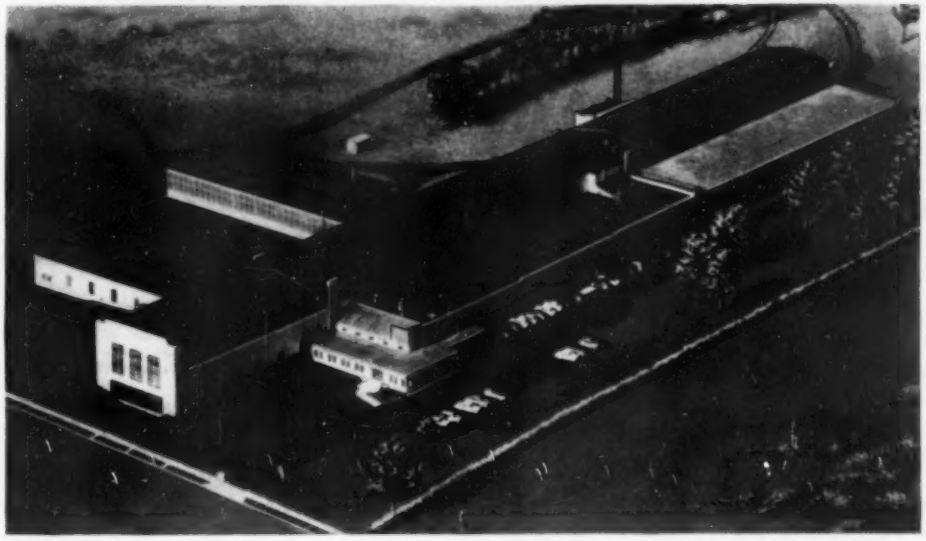

ENGINE LATHES

12"x6' Lodge & Shipley Geared Head, m.d., taper
13"x30" centers Pratt & Whitney Model B, m.d., taper
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Lodge & Shipley Geared Head, m.d.
14"x6' Pratt & Whitney, cone
14"x6' LeBlond, cone
14"x6' Sidney Geared Head, m.d.
14"x6' Springfield Geared Head, m.d., taper
14"x8' Prentice, m.d., taper
14"x8' Sidney Geared Head, m.d.
15"x8' LeBlond, m.d., taper
16"x36" Pratt & Whitney Geared Head, m.d.
16x54" centers American, m.d.
16"x6' Cisco Geared Head, m.d.
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' Lodge & Shipley, cone
16"x6' bed Monarch Geared Head, m.d.
16"x84" Pratt & Whitney Type B, m.d.
16"x8' Reed-Prentice Heavy Duty, cone, taper
16"x8' Monarch, cone, motorized
17"x6' LeBlond Geared Head, m.d.
18"x5' LeBlond Geared Head, m.d.
18"x6' bed Lodge & Shipley, cone, motorized
18"x6'6" Greaves-Klusman Geared Head, m.d. in leg
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Selec. Head, m.d
18"x8' Champion, cone
18"x8' Whitcomb-Blaisdell, Geared Head
18"x8'6" bed Walcott, cone, motorized
18"x10' Boye & Emmes, m.d.
18"x10' Springfield Geared Head, m.d., taper
19"x6' centers LeBlond Geared Head, m.d., taper, late
20"x10'6" bed Schumacher & Boye, cone, motorized
20"x8' bed American Geared Head, m.d., taper
20"x8' Cisco, cone
20"x8' bed Greaves-Klusman Geared Head, m.d. in leg
20"x8' bed Boye & Emmes
20"x10' Boye & Emmes, cone
20"x10' Lodge & Shipley Geared Head, m.d.
20"x10' Sidney Geared Head, m.d.
21"x8' Heavy Duty LeBlond Geared Head, m.d.
21"x10' LeBlond Geared Head, m.d.
23"x12' LeBlond Geared Head, m.d., taper
23"x12' LeBlond, cone, motorized
23"x14' bed LeBlond Geared Head, m.d., taper
24"x10' Greaves-Klusman Geared Head, m.d.
24"x12' bed Boye & Emmes, belt drive
24"x12' Bridgeford Geared Head, m.d., taper
24"x16' bed American, cone, motorized
24"x16' bed Cisco, cone, motorized
24"x24' bed Lodge & Shipley Geared Head, m.d., taper
24"x30' bed American Geared Head, m.d., taper, late
25"x10' bed LeBlond, Geared Head, m.d., taper
25"x12' bed Geared Head LeBlond, m.d., taper
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30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" bed Niles-Bement-Pond, m.d.
30"x16' bed Lodge & Shipley Geared Head, m.d., taper
36"x12' bed Lodge & Shipley, m.d.
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48" American (raised to swing 54") x 17' bed, m.d.
42" Putnam (raised to swing 56½") x 20' bed Geared Head, m.d., 11'8" centers
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18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
No. 21 Brown & Sharpe Automatic, s.p.d.
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No. 1 Brown & Sharpe, cone, motorized
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No. 3B Milwaukee, m.d.
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No. 2G LeBlond, belted m.d.
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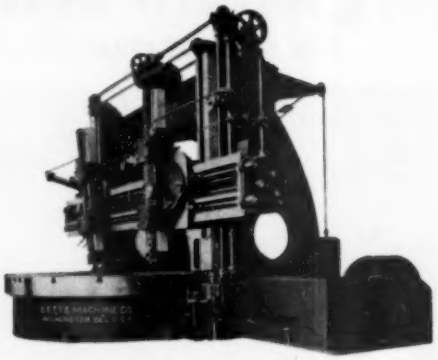

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Gleason #12 Generator Tool Sharpener, S/N 18606 (1940) Cap. both right and left hand cutters, of ½", 1-1/10", 1½", 2", 3½" and 6" diameter can be sharpened on this mach.

Dauber Kretsch Tool & Cutter Grinder, S/N 179 (1937). This machine is equivalent to a #13 B & S.

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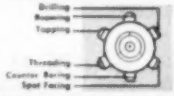

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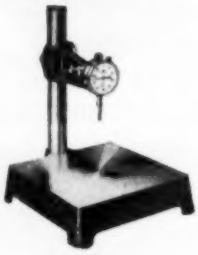

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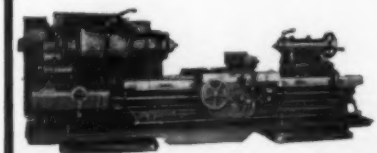

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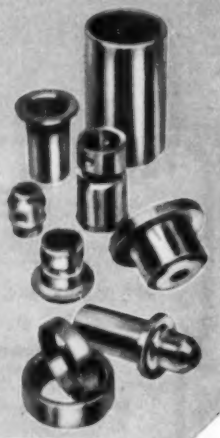

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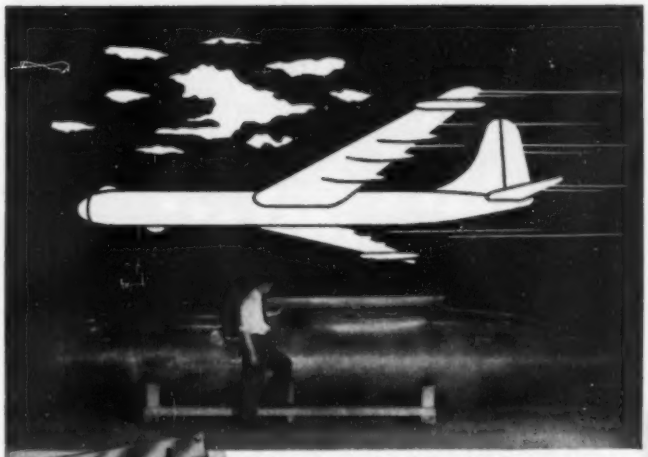

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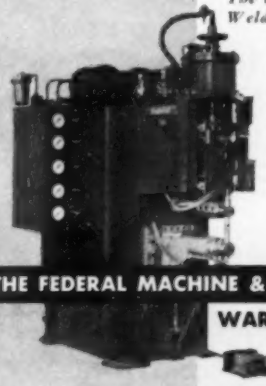

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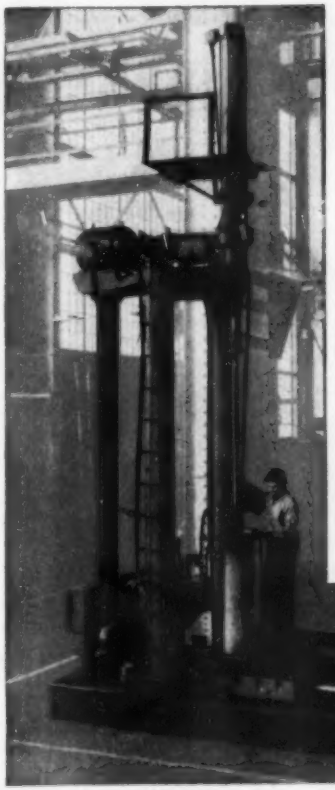
FULMER HONING MACHINES

for fast precision finishing of internal cylinders

• in bores

it's the internal smoothness that counts most of all

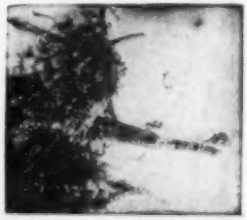


STOCK IS REMOVED by abrasive stones under controlled pressure in a rotary and reciprocating motion — simultaneously. This produces a round, straight bore to the finest degree of accuracy. Photo was taken doing just this in a large steel mill.

Internal cylinders from ½" to 30" diameter are finished to tolerances as close as .0001 (±). For ferrous or non-ferrous metals, plastic or glass.

THE CHIPS TELL THE STORY

A multitude of chips UP TO SIX INCHES LONG is shown here cut away from a steel hydraulic cylinder.



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C. ALLEN FULMER CO.

Now! A NEW CONCEPT IN POWER PRESS OPERATION

Pictured is Famco's 18-ton open-back, inclinable power press featuring the exclusive Electromatic clutch.

SOLENOID OPERATED CLUTCH

famco *Electromatic* 18-TON POWER PRESS

CHECK THESE FEATURES

1. EFFICIENCY—Solenoid operated, 9-point clutch positive-locking, jaws for greater efficiency.
2. ECONOMY—Less maintenance time . . . minimum production time losses.
3. SAFETY—Electrically controlled for safe operation, tooling.
4. LONG LIFE—Proved design, rugged, longer-lasting press.
5. EASE OF OPERATION—Feather-light foot or hand control.
6. SIMPLIFIED CLUTCH CONTROL—Selector switch for single-stroke, neutral, or continuous operation, while press is or is not running.

Famco now offers the most fool-proof, small power press clutch ever designed—the solenoid operated, nine-point jaw clutch. The handy selector switch provides ready changeability from non-repeat single stroke to continuous operation—from on to off position—plus, a neutral position which locks the clutch, making hand or foot controls inoperative.

The Electromatic 18-ton Power Press gives the greatest versatility and ease of operation, resulting in increased efficiency and production. For further details contact your nearest Dealer, or write for catalog.

famco (COST CUTTING) **machines**

FAMCO MACHINE CO., 3136 Sheridan Rd., Kenosha, Wis.

From the *American Machinist* Library of *Tips for Top Shop Men*

EVERY time you try something new, somebody will call it "a dangerous precedent." Remember that everything new is either wrong or a dangerous precedent to the timid. If you let such reasoning sway you, you'll never do anything new. Only ideas that aren't "dangerous precedents" are the duds.

IF you're planning to introduce a labor-saving method that will displace men, and you know there'll be a kickback, get it set to go anyway. Then wait for "evaporation" — normal quits and dismissals — to cut your working force to the newer, lower, level. There'll be no trouble—if your men trust you and the company.

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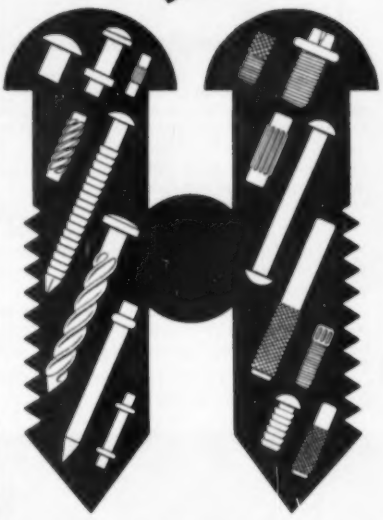
HASSALL SERVICE



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Hassall ESTABLISHED 1850

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COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels—High Speed Steels Die Steels—Hot Work and Shock Resisting Steels Carbon Tool Steels.

TOOL COLUMBIA STEELS

faster set-ups, greater accuracy assured by SCAN-A-SCALES

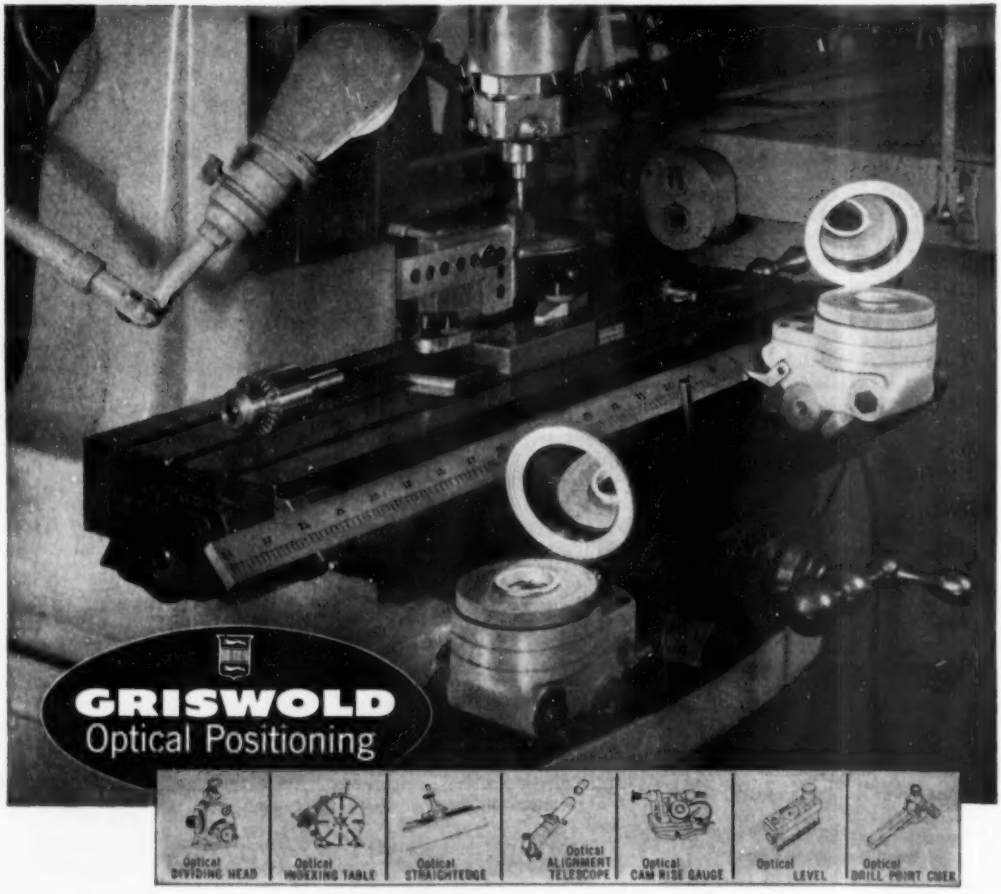
MAKES A PRECISE MACHINE OF THIS LOW COST JIG BORER

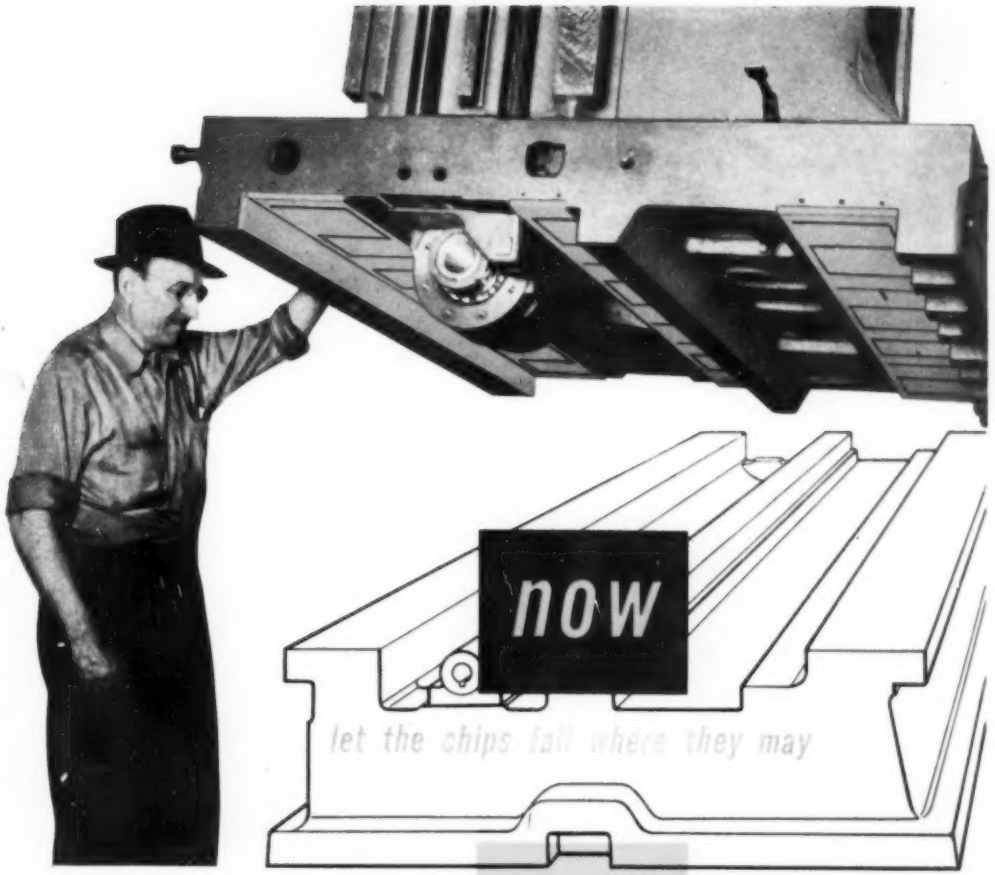
Jacques Kreisler Manufacturing Company, world famous manufacturer of watch bands, have mounted Scan-A-Scales on a jig borer in their tool and die shop. Faster set-ups and greater accuracy is now assured over the micrometer settings formerly used. According to Methods Supervisor, Eric Sundberg, Scan-A-Scales have transformed one of their low cost jig borers into a precise, reliable machine. Accuracies to ±.0002" and even closer can be expected.

Scan-A-Scales provide precise and simple methods of making linear measurements on machine tools and permit direct visual settings with the advantages only optical precision can give. They eliminate inaccuracies due to variations in pressure found in micrometers and loose standards. No attention to lead screw settings and no focusing is required.

Because Scan-A-Scales speed work and increase accuracy, machine tool manufacturers are now including them as original equipment. You too can get these real benefits by installing Scan-A-Scales on new and old machines in your shop.

Write today for your free copy of our new illustrated catalog. F. T Griswold Mfg. Co., Wayne 1, Pa.

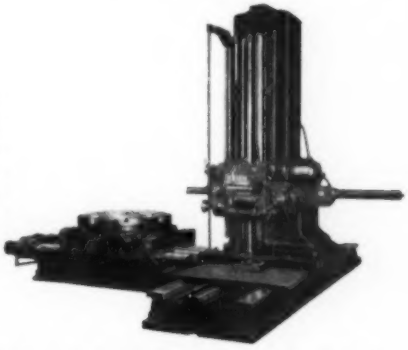




CINCINNATI GILBERT'S **new**

NON-METALLIC WAYS

Now Cincinnati Gilbert brings you non-metallic way blocks to ride between the column base and the runway in floor type Horizontal Boring Machines. Field tests indicate that with average lubrication and cleanliness this development *extends service life of the ways almost indefinitely.* Wear is negligible and accuracy is maintained. . . . The new way blocks are made from phenolic laminates, sliced edgewise to fiber grains. . . . This is just another of many reasons for specifying "Cincinnati Gilbert" on your next horizontal boring mill purchase. . . . The Cincinnati Gilbert Machine Tool Company, 3360 Beekman Street, Cincinnati 23, Ohio.



THOSE WHO BUY GILBERT BUY GILBERT AGAIN

NOW GRAPH-MO® TOOL STEEL IN HOLLOW BAR FORM

New "Graph-Mo Hollow-Bar" combines the faster machining and longer wear of Graph-Mo with the economy of a hollow bar section

ADVANTAGES OF GRAPH-MO

- Most stable tool steel ever made
- Outwears others 3 to 1
- Machines 30% faster
- Minimum tendency to pick up, scuff or gall
- Uniform response to heat treatment

PLUS

ADVANTAGES OF HOLLOW BARS

- No drilling
- Finish boring is first step
- Less machining time
- Less scrap loss
- More parts per ton of steel

EQUALS

ADVANTAGES OF "GRAPH-MO HOLLOW-BAR"

THE Timken Company announces a new product—"Graph-Mo® Hollow-Bar"! It gives you all the advantages of Graph-Mo tool steel, *plus* the advantages of a hollow bar section.

If you make ring-shaped tool steel parts you can eliminate drilling, make finish boring your first production step. You save machining time, save steel! The hole is already there!

And you get all the proven advantages of Graph-Mo—a special tool steel that contains free graphite and diamond-hard carbides in its structure.

Graph-Mo outwears other tool steels an average of 3 to 1! Reports from dozens of users prove it!

Machinability tests show Graph-Mo machines 30% faster than other tool steels!

It's the most stable tool steel made! A 12-year stability test of a typical Graph-Mo steel master plug gage showed less than 10 millionths of an inch change in dimension.

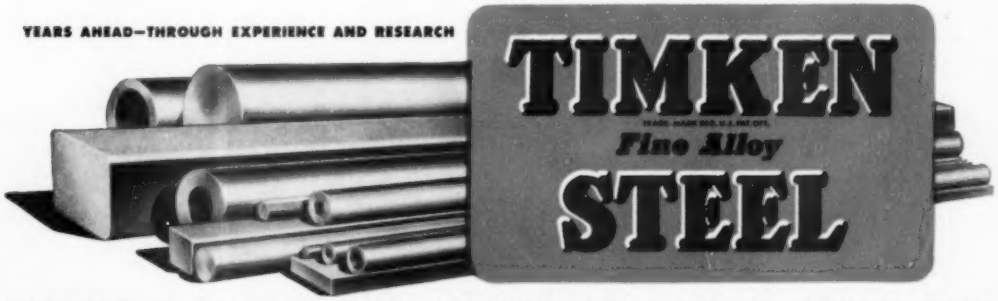
Graph-Mo has minimum tendency to scuff, pick up or gall. And it gives uniform response to heat treatment.

Add it all up and you've got "Graph-Mo Hollow-Bar"—the big news of the year for makers of ring gages, dies and other annular tool steel parts.

"Graph-Mo Hollow-Bar" is available in sizes ranging from 4" to 16" O.D. with a variety of wall thicknesses. Distributed through A. Milne and Company and Peninsular Steel Company, it's available in the following cities: New York, Boston, New Britain, Philadelphia, Buffalo, Pittsburgh, Cleveland, Akron, Dayton, Toledo, Detroit, Grand Rapids, Indianapolis, Chicago and San Francisco.

Write today for complete information to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING